THE POWER OF JUSTICE

Spatial Strategies for a Fair Energy Transition in North - West Europe

PREFACE

'The Power of Justice. Spatial strategies for a fair energy transition in North-West Europe.' is a research, vision and proposal for spatial strategies and policies to achieve a just and resilient energy transition in the area of and in-between Rotterdam and Ruhr-area in 2050. This proposal is made by Arjanne van der Padt, Hasan Hashas, Małgorzata Rybak and Jing Spaaij during the MSc2 courses AR2U086 R&D studio Spatial Strategies for the Global Metropolis and AR2U088 Research and Design Methodology for Urbanism (Mastertrack of Urbanism, Faculty of Architecture and the Built Environment, Delft University of Technology).

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ABSTRACT

Key words: Geopolitics, Energy Transition, Social Justice, Spatial Justice, Rotterdam, Ruhr-area

The energy industry is responsible for almost 89% of GHG emissions (IEA, 2022), and projected CO2 emissions would exceed the 1.5°C goal (IPCC,2023). There is no question that we need to transition towards renewable energy sources, it has become an urgency and we need to transition now.

However, there are several challenges within this energy transition. Renewable energy sources require better spatial planning in terms of land-use. Its production and the stability of energy systems require reliable and resilient geopolitical relationships. It is also a challenge to ensure affordability and accessibility of renewable energy, as well as the acceptance of the transition towards renewables. We have to tackle all these challenges while involving nature as an actor.

We aim to achieve a just and resilient energy transition by 2050. This means creating secured geopolitical relationships, ensuring affordable, accessible and fair distributed energy and regenerating ecology in the process. These goals are divided into three main pillars: Geopolitics, Social aspects and Ecology. With circular economy as one of our theoretic frameworks combined with our pillars, we create our conceptual framework. In this report we will also make use of other theoretic frameworks like resilience, spatial and social justice, the pattern language and panarchy theory.

Spatial analysis and literature research have concluded in several strategies to ensure a just and resilient energy transition. We will zoom into the region of and between Rotterdam and Ruhr-area. On this scale we will determine areas of specialised and generalised production; inter-connection of energy production landscape and expanded protected nature areas; mixed land-use of energy production, agriculture, the urban fabric and natural areas. On a local scale we will explain two different systems of rural decentralised energy systems with a bottom-up approach.

The 'Power of justice' aims for a future that is resilient and just because of strong geopolitical relationships and an improved energy grid. We not only consider present life but also the future of human and non-human generations.

CONTENTS

THE WHY

CONTEXT & SCALES

As regional planning is a main focus of the third quarter of the MSc Urbanism curriculum, this project's centre of attention is energy transition in North-West Europe. To fully understand how economy and geopolitics influence social, cultural as well as environmental changes we need to work between scales. It is important for us to understand the relationships in this complex system and how they affect local audiences. In order to see these relationships, we must simultaneously consider the international scale, the scale of the country, the province, the city and the town. Starting from international scale (North West Europe) we created a vision for energy transition, then the strategic plan for cooperation between Rotterdam-NIjmegen/Arnhem-Ruhr in which we zoomed in to each hub. Finally, we simulated the strategy's performance on a local scale in Achterhoek and the area near Oostgaarde.

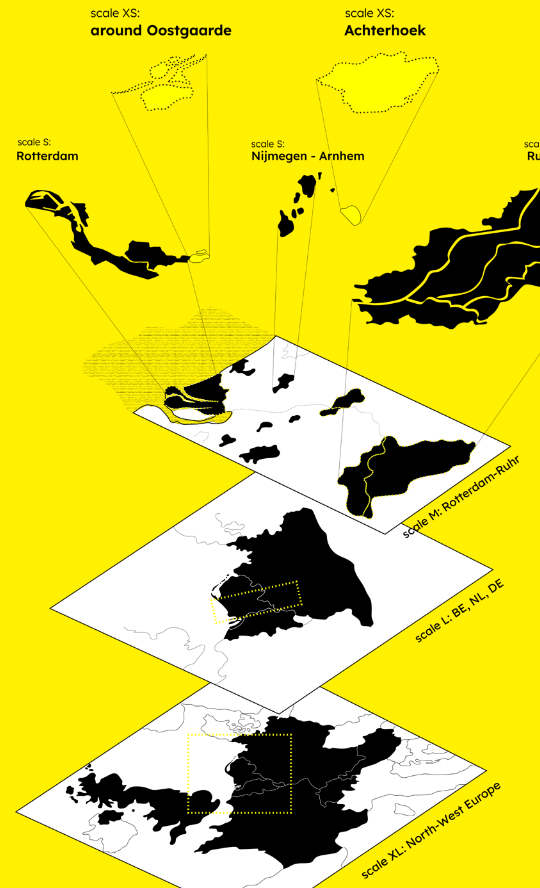

Figure 1

URGENCIES

The world faces an urgent environmental crisis that requires immediate action.

The impact of climate change is not limited to just the environment, as it also has significant implications for human health, economic stability, and social well-being (World Health Organization, 2021; Intergovernmental Panel on Climate Change, 2021; IPCC).

Coal is the most carbon-intensive energy source, emitting 1942 kg of CO2 per megawatt-hour (MWh), while renewable energy sources such as solar, wind, and hydro have much lower emissions, with an average of around 30 kg/MWh (Our World in Data, 2021). However, despite the clear benefits of transitioning to renewable energy sources, not everyone is ready to take immediate action (The Guardian, 2022; NPR, 2023; CNBC, 2023). Another challenge is the geopolitical relationships surrounding energy production and consumption (CNBC, 2023). Additionally, countries have different levels of development, which means that some may have limited resources to invest in renewable energy sources (World Bank, n.d.). Therefore,

Therefore, it is crucial to prioritise a comprehensive approach that takes into account all these challenges.

The shift towards cleaner sources of energy is not without its challenges, as the electricity grid is already struggling to meet the increasing demand for power (The Guardian, 2022). Research also shows that renewable energy sources take up more space to produce energy than fossil fuels (Echavarria et al., 2012). This brings us to the dilemma and urgency of spatial justice, where the benefits and the burdens of energy production should be allocated fairly (Agyeman et al., 2013).

In conclusion, urgent action is needed to address the growing concerns about climate change. The world must prioritise a comprehensive approach that takes into account the challenges posed by geopolitics, lack of space, social justice and equity, and ecological concerns.

Recent news shows a delay in an energy transition rather than taking urgent actions towards it.

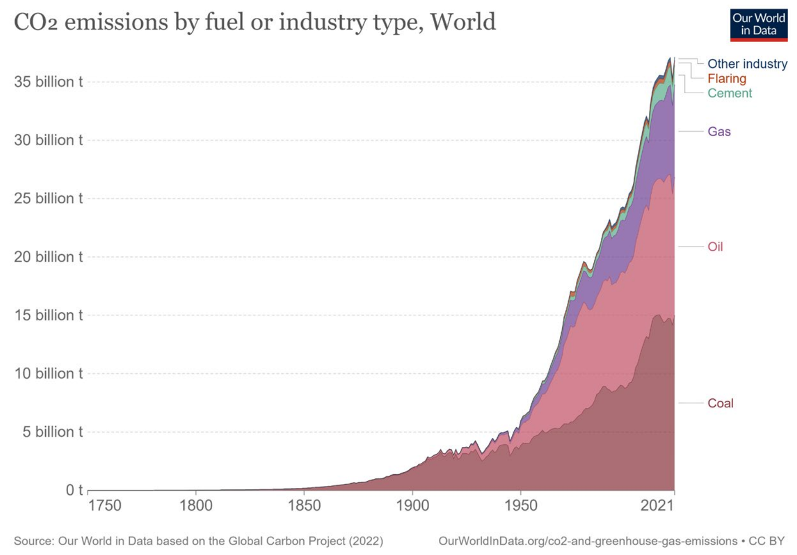

Figure 2

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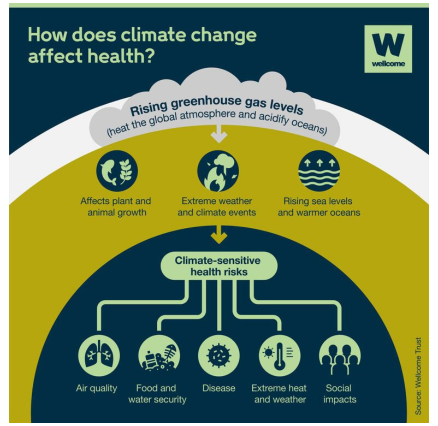

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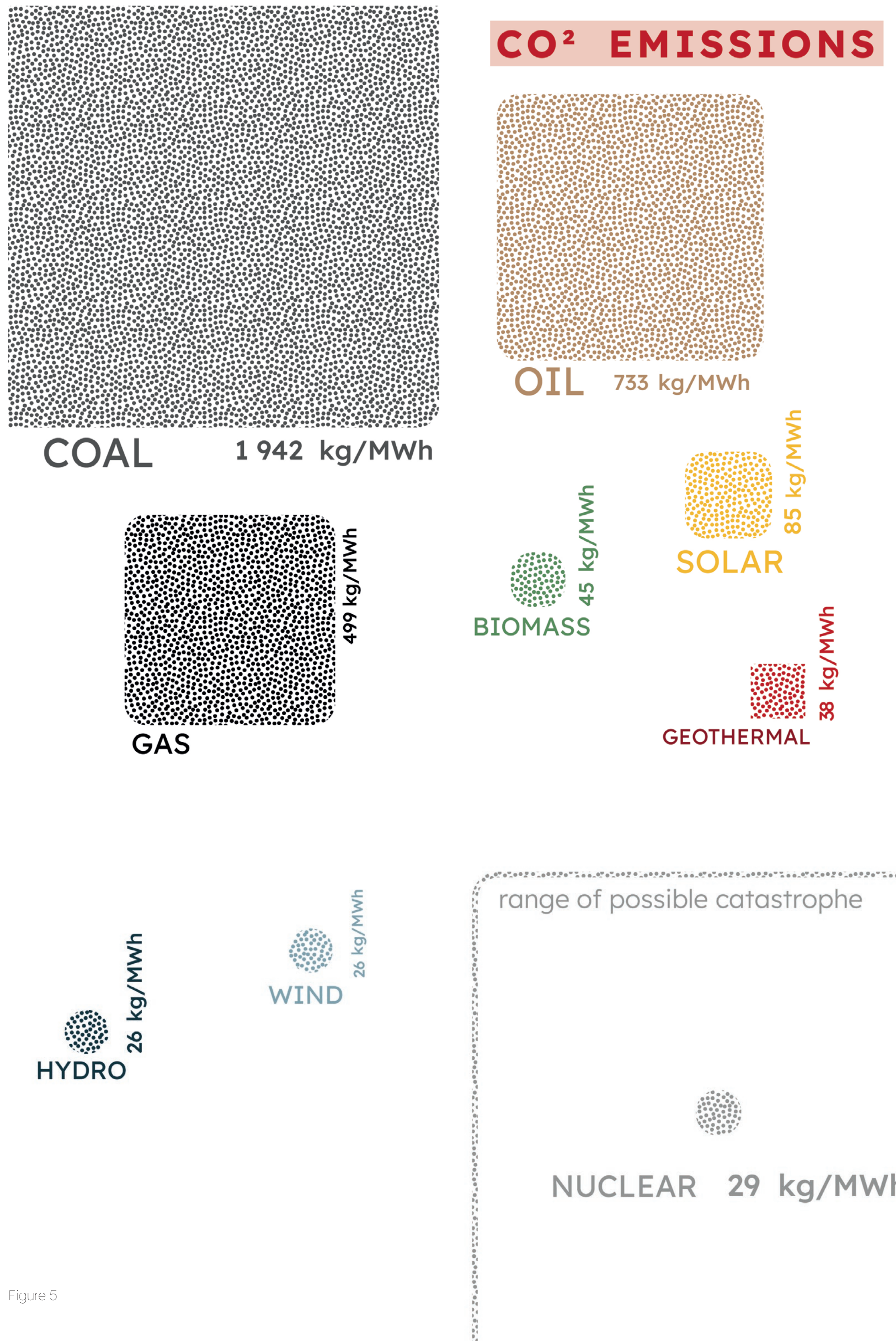


Figure 5

PROBLEM STATEMEMT

As the AR6 Synthesis Report: Climate Change 2023 notes, the failure to achieve climate protection agreements and goals has resulted in projected CO2 emissions from existing fossil fuel infrastructure that exceed the remaining carbon budget for 1.5°C.

Given that the energy industry accounts for nearly 89% of energy sector greenhouse gas emissions (IEA, 2022), urgent action is necessary to address related issues. In North-West Europe, transitioning from fossil to renewable energy systems presents significant spatial planning challenges, particularly in rural areas where much of the burden of providing space for renewable energy production falls.

Geopolitical considerations are also a major concern, as the production of renewable energy requires collaboration among countries with and without resources. The uncertainties and volatility in political relationships can impact the security and resilience of energy systems, leading to challenges in the supply and distribution of energy. It is crucial to ensure a secure geopolitical relationship to ensure the long-term stability, sustainability of renewable energy systems, and better policy shaping.

Social and spatial justice and equity must also be prioritized in the energy transition, taking into account issues such as energy poverty, affordability, social acceptance, and the sharing of benefits and burdens.

This shift requires extensive spatial planning, as noted by the International Energy Agency. Therefore, it is critical to address these challenges in order to mitigate the impact of climate change and resource depletion.

At the moment the benefits of renewable energy production are not yet shared fairly and the burdens are disproportionately borne by marginalised communities.

Finally, the shift towards renewable energy must consider the impact on nature and ecology, as the production and disposal of renewable energy infrastructure and materials can still have negative environmental consequences. Sustainable practices must be prioritised, and the impact on nature and ecology minimised.

In summary, South-Holland faces significant challenges in the transition to renewable energy, relating to spatial planning, geopolitical relationships, social justice and equity, as well as ecological concerns. A comprehensive approach that takes into account these challenges is necessary to ensure a successful and sustainable transition to renewable energy.

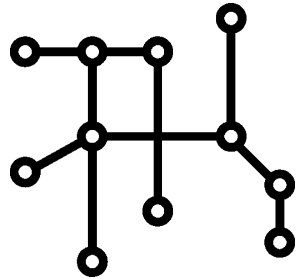
RESEARCH QUESTION

How can we achieve a just energy transition in North West Europe & how can spatial planning, local-regional-international policies & cooperation support them?

WHICH METHODS DID WE USE?

THEORETICAL FRAMEWORK

In order to achieve a just and resilient energy transition, the meaning of this should first be defined. Here, the definitions of resilience, social and spatial justice for this project are defined through literature research. Additional theories concerning energy transition and spatial design that set a basis for this project are also explained here: circular economy, the R-ladder, the X-curve and a pattern language.

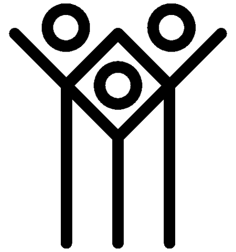


Resilience

In general, resilience means to withstand damage, adapt to changes and/or be able to recover from shocks (Resilience Tools, 2023). In this project, resilience is defined further within two types: community/ geopolitical resilience and resilience in energy systems.

Geopolitical relationships function similarly as within a community. People work together towards common goals while keeping personal ideals in mind. Resilience in both these systems can be defined by the following standards. Community resilience is built upon six foundations (Lerch, 2023): people, systems thinking, adaptability, transformability, sustainability and courage. A community builds its resilience with community members. System thinking is needed to understand the complexity of crises and a community should continuously adapt to changes. When some challenges are too big for communities to adapt to, having the ability to transform is resilience. Sustainability means that the community should also serve others, future generations and the ecosystem. At last, courage is needed to confront challenging issues and take responsibility for the collective future.

Resilience in energy systems is more elaborate on technicals and less on people and relationships. Nik et al. (2021) state that resilience is for example defined as the ability for an energy system to “meet performance levels as it is in normal operation during a disruption” and to “have a secure energy supply and continue delivering affordable energy services to consumers.”. So, resilience in energy systems is very much related to energy security (SafetyCulture, 2022). In order to achieve a resilient energy transition, this project follows the components of energy security defined by SafetyCulture (2022): Availability, Accessibility, Acceptability and Affordability.



Spatial justice

Spatial justice implies two types of justice: distributional justice and procedural justice (Rocco, 2015). Distributional justice is about fair allocation of and access to resources in space (Rocco,2015), meaning the benefits and burdens of resources are fairly distributed (Stanford Encyclopedia of Philosophy, 2017). Procedural justice focuses on the process of decision on the allocation of resources (Rocco, 2015; Ostrom, 1990). It is a difficult task to ensure spatial justice as many complex problems need to be tackled. Issues like regulations, property, the role of state, individual and collective rights, spatial planning, power asymmetry and spatial asymmetry (Rocco, 2023) should be considered simultaneously, but finding the ‘perfect’ solution is a wicked problem. This project, within the definition of spatial justice, attempts to tackle the problem of accessibility of energy.

Social justice

The definition of social justice given by Duignan (2022) is “The fair treatment and equitable status of all individuals and social groups within a state or society.” Social justice also implies “the equal opportunity to contribute to and to benefit from the common good” (Duigan, 2022). Adapting this definition, this project aims to leave no one behind and achieve social justice by ensuring the affordability and acceptability of renewable energy. In addition, through this project’s strategy, several public goods can be created following this framework.

Pattern language

The pattern language developed by architect Christopher Alexander (1977) and his colleagues was a guide with design patterns for a humane living or built environment. The patterns describe the problems and the core of a solution that can be used in various ways. Each pattern is linked with another pattern, thus creating a pattern language. This idea was adapted into different fields of design (Coplien et al., 1995) as it provides a systemic approach for analysing sites, developing place based visions, supporting design processes and helping monitor the state of urban manufacturing (Hill, 2020). This project uses the pattern language as a participatory tool to facilitate co-creation between stakeholders. This will be explained further in later chapters.

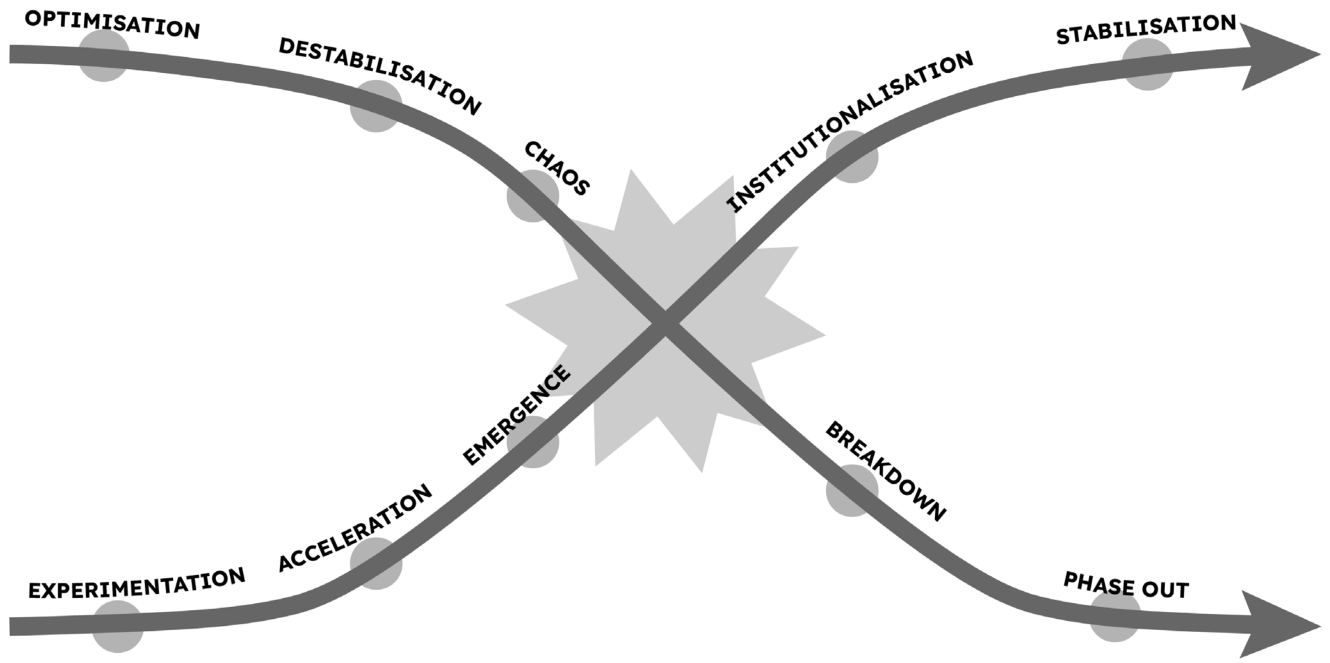
WHICH METHODS DID WE USE?

THEORETICAL FRAMEWORK

X curve & Panarchy

The energy transition is dynamic and consists of various phases. The x-curve (figure X) provides a framework in which the development stages of a transition can be simplified and explained (Hebinck et al., 2022). Various actions of events of a transition can be placed on the x-curve to help understand the position of the transition, whether or not we are in the destabilisation phase or stabilisation for example. This x-curve can thus also help explain the phasing of this project. Actions and policies proposed can be placed on the x-curve to get an understanding of their effect, like when some policies will destabilise the current energy system and then others have to stimulate stabilisation.

Transitions, especially the energy transition, are not linear. For example, when renewable energy is institutionalised and stabilised, a new transition will be needed in the future to keep up with the technology and values. This is in line with the panarchy framework (Resilience Alliance, n.d.) where this infinite adaptive cycle is illustrated. This project's conceptual framework adapts this idea and reserves room for future transitions.



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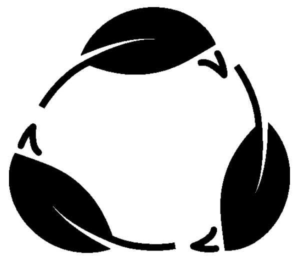


Circular economy

Circular economy focuses on the efficiency of raw material usage and keeping the raw materials in the production chain for as long as possible (Planbureau voor de Leefomgeving, 2023). The circular economic framework contains nine R-strategies (figure X, R-ladder) that examine how materials can be used and reused (Topanga, 2022). These strategies are then placed on a 'ladder' depending on their value. The higher up the ladder, the fewer raw materials are needed. Working towards a circular economy also means that we step away from the reuse economy. It is no longer enough to just close the loop of material circulation, we must aim to slow or narrow the loops. Ideally we should then aim to regenerate the biosphere and repair the damage done. This step following up on the circular economy is the regenerative economy and this project aims to incorporate their circularity strategies.

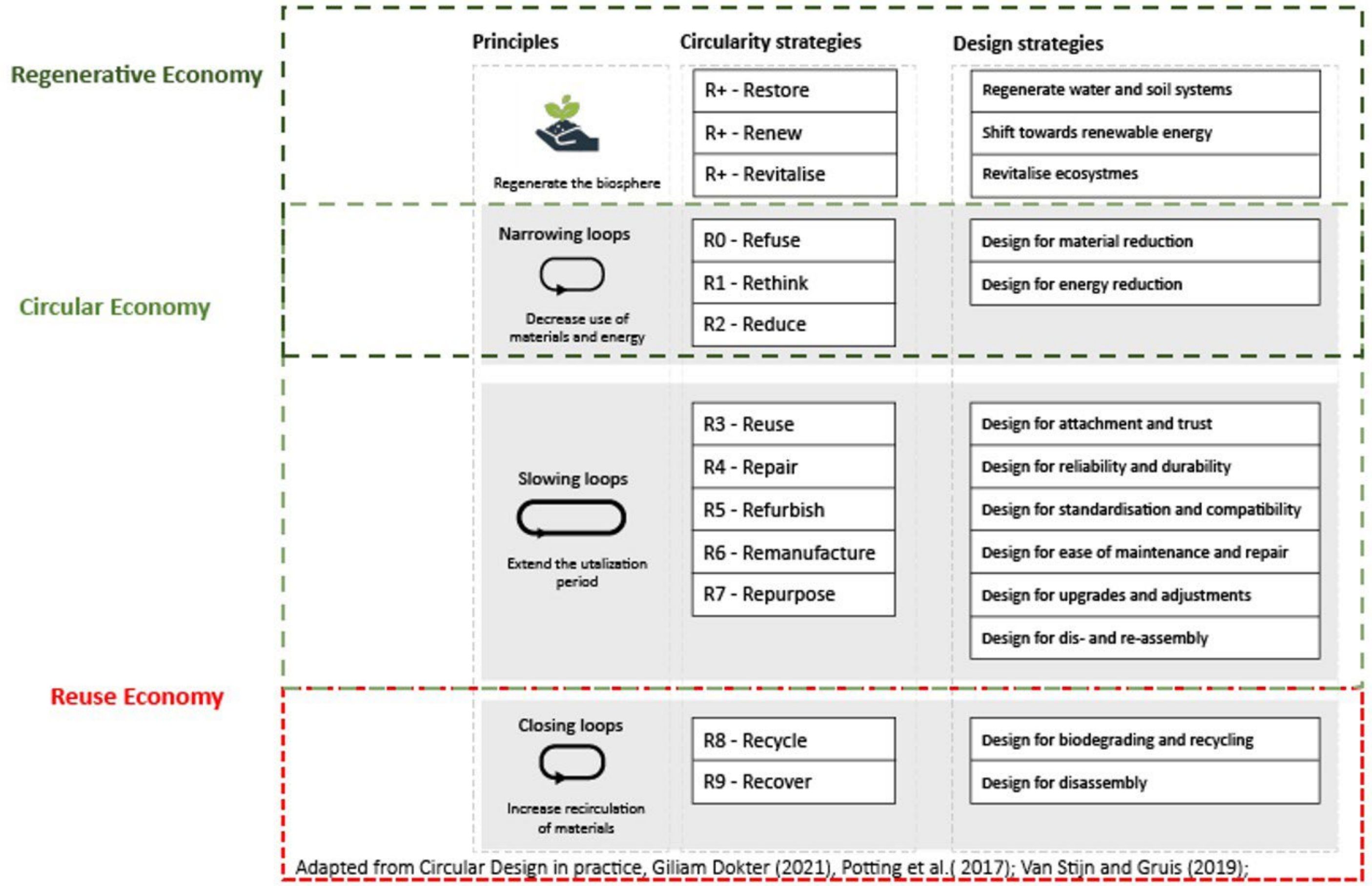


Figure 7

WHICH METHODS DID WE USE?

METHODOLOGY FRAMEWORK

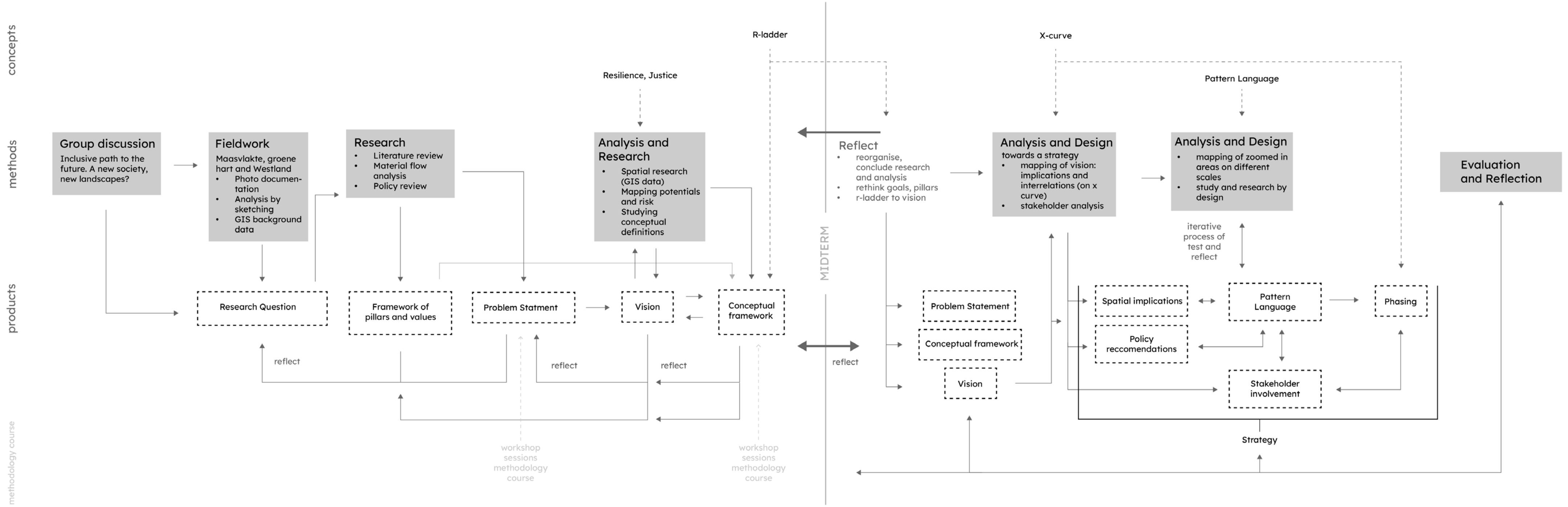


Figure 8

As shown in figure 8 our project started with a group discussion and fieldwork in South Holland. This led to the first questions and the start of research and analysis. A literature review, material flow analysis and policy review brough us insight into the different energy sources and geopolitics and social issues around energy. This research led to a framework of pillars and values and a first problem statement, with a push of the workshops sessions of the methodology course. With this, the research question was also revised. A spatial analysis and conceptual refining lead to the first conceptual framework, reflection on the problem statement and building up the first vision.

After the midterm, there was a big moment of reflection on the problem statement, conceptual framework and vision before moving towards a strategy. Analysis and designing led to the first spatial and policy implications, with the help of the concept of x-curve. These were structured in a pattern language to gain insight into the interconnectedness. Then an iterative process of testing and reflecting between the pattern language, spatial and policy implications on different scales and stakeholder involvement started. In this process, the interrelations between the patterns were also constantly explored (see Appendix (pg X) for the matrix diagrams of interrelations of the patterns). The duration of the process of reflection and design was limited by the course's length. The step of phasing was made by reflecting on the patterns on the x-curve. Lastly, evaluation and reflection on the strategy, vision and process, gave insight into limitations, application and (scientific) relevance of the project.

CONCEPTUAL FRAMEWORK

Circular economy (PBL, 2018) provides a framework in which the steps towards a just and resilient energy transition can be categorised and explained. In order to achieve this in 2050, we need to upgrade from past values and strategies. Up until recently, the general approach towards a circular economy is recycling (PBL, 2018). In the conceptual framework this is considered a past value. Strategies 'higher' in the R-ladder of the circular economy like 'Restore', 'Renew' and 'Revitalise' require fewer materials and aim to repair the damage done to the biosphere. In the future we will upgrade from these strategies following the panarchy theory (Resilience Alliance, n.d.), and in this energy transition we also no longer aim to just recycle and use strategies higher up the R-ladder. We assume that future generations will create new values, hopefully even more advanced. To be just and resilient, the energy transition should consider both men and nature, therefore we aim to regenerate ecology, achieve social and spatial justice and secure geopolitical relationships.

Starting with 'Repurpose industry and infrastructure' through 'Reduce energy use', 'Rethink energy system and lifestyle', 'Refuse non-renewable resources', 'Revitalise ecology and community', 'Renew energy' and ending with 'Restore trust and ecology' we aim to reach a resilient and just future.

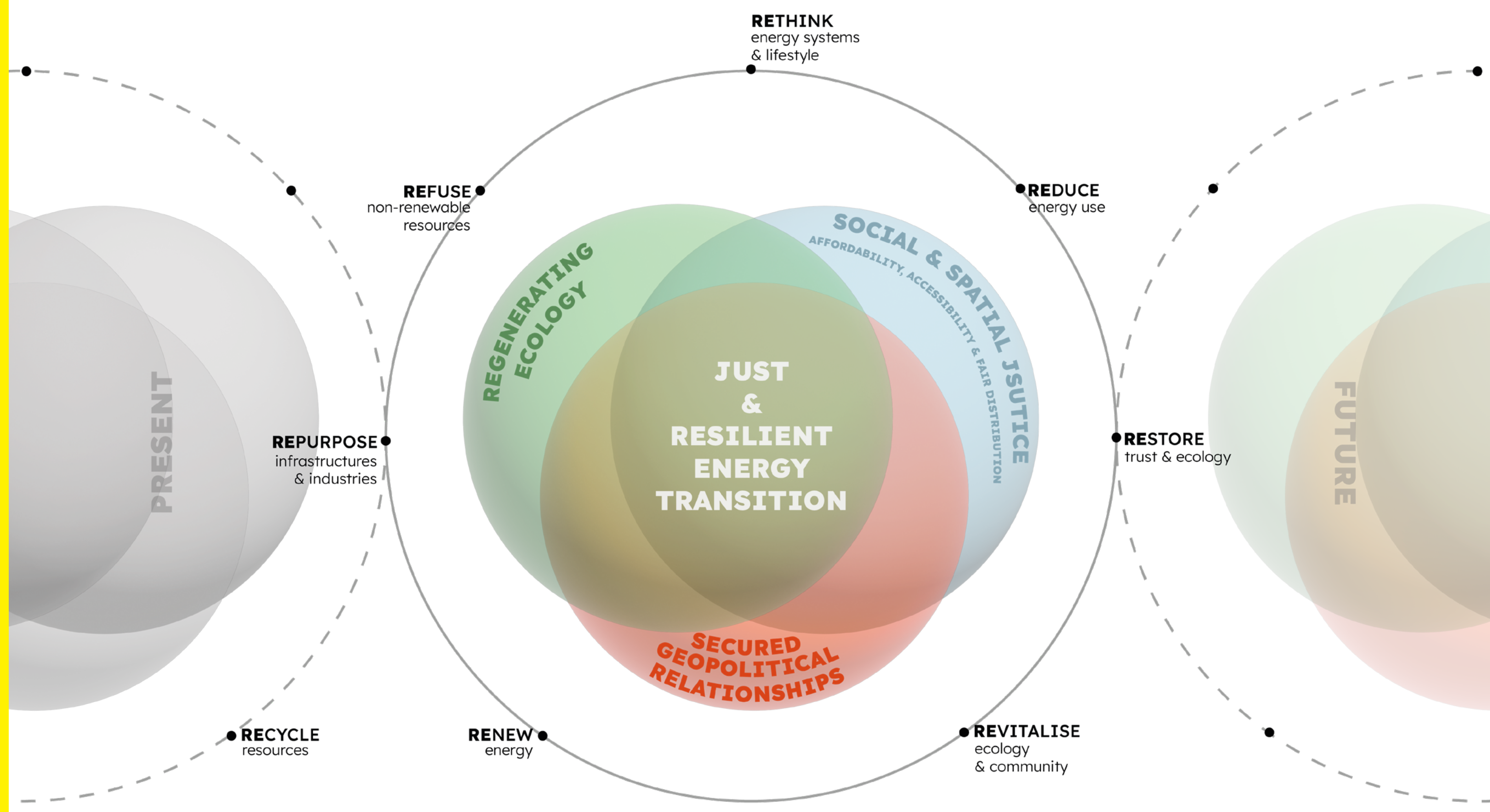


Figure 9

WHAT & WHO

ENERGY ANALYSIS:

Emissions & space

In this chapter, we will present the analyses that broadened our understanding of energy production and the infrastructure associated with its transmission/storage, the impact of the energy transition on the geopolitical, socio-ecological and spatial situation.

The starting point is the influence of energy production and specific sources of energy. There are sources that are phasing out currently (oil, gas, coal, nuclear power) and sources that we believe to be future-proof (solar, wind, hydro, geothermal and biomass energy).

Each was analysed by spatial coverage of necessary infrastructure (m2/MWh), generated emission of CO2 (kg/MWh) and current global energy demand (MWh). That gave an overview of needed changes. It is undeniable that relying on energy production from non-renewable resources should be stopped, due to their high emissions that are harmful to the environment and health. Because of the high impact of catastrophes and the toxic waste that nuclear power carries, it is not a future-proof resource. Planning for a future based on renewable energy resources should take into account the significant expansion of energy-producing areas, especially considering that the current demand will be based entirely on renewable energy sources. This will be one of the challenges faced by this project.

	PHASING OUT				TRANSITION TO				
	OIL	GAS	COAL	NUCLEAR	SOLAR	BIOMASS	WIND	HYDRO	GEOTHERMAL
SPATIAL COVERAGE	15 m²/MWh	2,3 m²/MWh	46 m²/MWh	0,3m²/MWh	57,8 m²/MWh	200 m²/MWh	99 m ²/MWh	47 m²/MWh	1,2 m²/MWh
EMISSIONS kg CO2e/MWh	733 kg/MWh	499 kg/MWh	1 942 kg/MWh	range of possible catastrophe 29 kg/MWh	85 kg/MWh	45 kg/MWh	26 kg/MWh	26 kg/MWh	38 kg/MWh
current DEMAND consumption MWh	5 117 MWh	40 375 MWh	44 473 MWh	7 031 MWh	2 702 MWh	11 111 MWh	4 872 MWh	11 183 MWh	2373 MWh

Figure 10

ENERGY ANALYSIS:

Systemic section

The current system is very reliant on fossil fuels like oil, gas and coal. These resources emit greenhouse gases that pollute our environment. We also rely on the global supply chain for these resources, which consumes a great amount of energy just on transportation and transformation of resources.

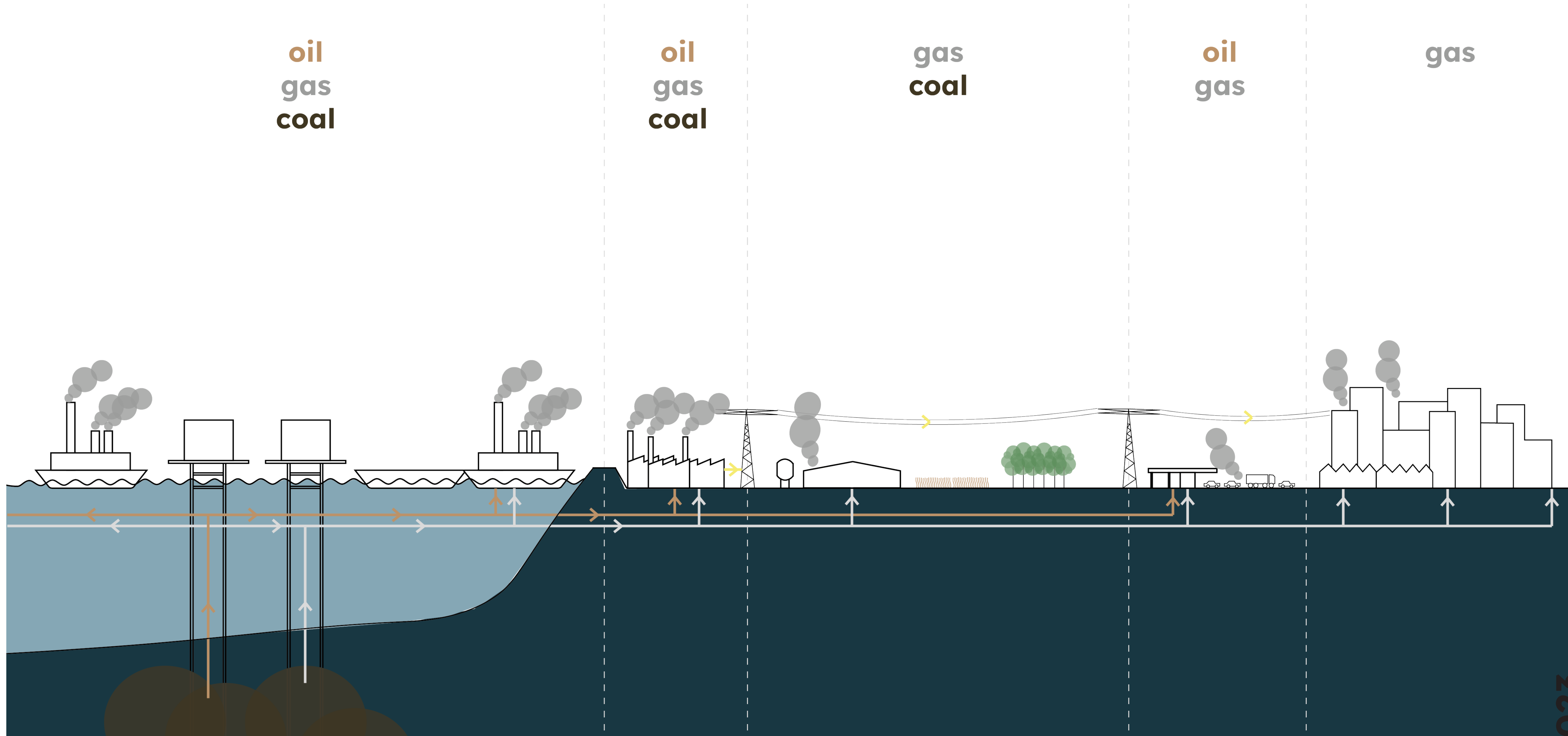


Figure 11

WHAT & WHO

ENERGY ANALYSIS:

Relating energy resources to ecology, society and geopolitics

Presented table is a summary of our extended analysis of non-renewable and renewable energy sources. Dimensions in which we researched them were: general knowledge, relation to social, geopolitical and ecological issues. Findings were divided into positive (+), neutral (+/-) and negative (-) effects.

To conclude our findings we determined lessons and risks. The main dangers of phasing out non-renewable sources of energy are: current dependance on the resource, possible market destabilisation, energy poverty and loss of jobs. There are also noticeable opportunities like repurposing existing infrastructure and hubs and incentivizing companies to retrofit. Learning from the post industrial energy transition there is a need to focus on left behind people and areas, as well as making the process of change transparent and reliable.

Conclusions from analysing renewable resources brought important lessons as well. For future energy transition it will be important to create a multifunctional landscape with respect to nature and sea, adapt use of source to scale,time and landscape potential. During these changes, it will be important to take into account the risks associated with offshore investments, the retraining of employees and making the energy transition more socially acceptable. In order to build a resilient system, international cooperation and loyal relationships will play a major role.

	PHASING OUT				TRANSITION TO				
	OIL	GAS	COAL	NUCLEAR	SOLAR	BIOMASS	WIND	HYDRO	GEOTHERMAL
GENERAL	+/- an extensive infrastructure with future potentiality +/- The Netherlands as an important hub + Maasvlakte, Boltek, and Alblasserwaard as potential areas for repurposing oil functions and services	+/- huge infrastructure network +/- affordability: relying on gas - important players: huge industry of gas processing, exchange and extraction (underland, under sea)	- coal still used in the Netherlands to produce electricity - coal mines in Limburg closed in 70s + retrofitting old mines for gravitational energy storage?	+ effective & efficient + manageable waste (storage vs. emissions) + lowest emissions - impossible to rechycle waste - high danger in case of catastrope - The Netherlands imports nuclear power fromBE,G,FR	- Land use change - Maintenance and disposal challenges + Reduced carbon footprint + Reduced air pollution + Reduced dependence on imported energy	- space coverage - waste: energy, chemicals - need energy-input (endotherm) to process +/- any bio-input is possible and many methods to get different products as output + decreased GHG emissions	+ already ongoing plans + possibility of a tidal energy production +/- mostly offshore possibilities for the Netherlands - short lifespan of infrastructure (ex.turbines) & storage demand		+ accessible all over the world + reliable and renewable resource + heat: heat or electricity closed loop of used water
ECOLOGY	- greenhouse gas emissions, air and water pollution - transportation and storage of oil pose significant environmental and public health risks.	- gas extraction causing earthquakes - energy industry replacing and spoiling nature (on sea and land) - 72 Billion kg CO2 because of gas	- high emissions - land condition after mining	- high-level nuclear waste need to be cooled for around 100 years before they get stored for another 100.000 years - impact of uranium ore mines to be determined - where to make space for storage	- big land cover - lifespan of technology - dependent on time and climate	- deforestation could happen - careful about source of input and the method of process - combine different energy sources to flatten duck curve	- intervention on sea - materials for turbines, new infrastructure etc. with lifespan of 25 years - fauna and flora influenced by machines - system on land stays the same		- could cause earthquakes - leakages could cause release of toxic particles in the atmosphere
GEOPOLITICS	- diversification of oil supplies - market risks: the Netherlands relies heavily on oil + Cooperation with the EU + Promotion of sustainable oil production + Support for international cooperation	+/- shared gas infrastruc-ture between countries +/- The Netherlands as a gas roundabout in North-west Europe	- dilemma: back to coal or Russian gas? - emissions cross borders!	- nuclear plants are expensive to build (takes 8-11 years) - reliance on uranium ore mines abroad - The Netherlands functions as a refinery for uranium ores and exports 81 kg per year	- 75% are imported from china - there's a local production but it's not enough + a big potential collabo-rating with Norway	- little to no need for inter-regional dependen-cies or cooperation	+ The Netherlands as future distributor of wind: H² power +/- North Sea as international production area - Where to get raw materials from?		- some areas are more efficient for geothermal +/- cooperation is needed to create heat-networks +/- policy is needed to make it more affordable for individuals
SOCIAL	- significant negative environmental impacts - security risks the Netherlands relies heavily on oil + Oil-generated energy is reliable, affordable, and provides jobs in the Netherlands.	- to learn from the situation with Groninger gas - 16.500 jobs in gas industry - expensive gas, energy poverty, energy crisis	- health consequences mining and emissions - Ex-coal mining area in Limburg still a lot of poverty and unemployment	- very low social accept-ance - waste storage will only build up for future generations and not decrease - expensive investment, less affordable	- Visual impact - Community acceptance + Community involvement: Community-owned solar projects can promote social cohesion + Energy poverty in the Netherlands. Local solution.	+ retrofitting farms as energy producers + affordable and reliable resource - low social acceptance because of possible smells (depends on methods of execution)	+/- loss of jobs & new jobs -access to energy grid -social acceptance - how much do we consume?		+ accessible for everyone - however not always affordable

Figure 12

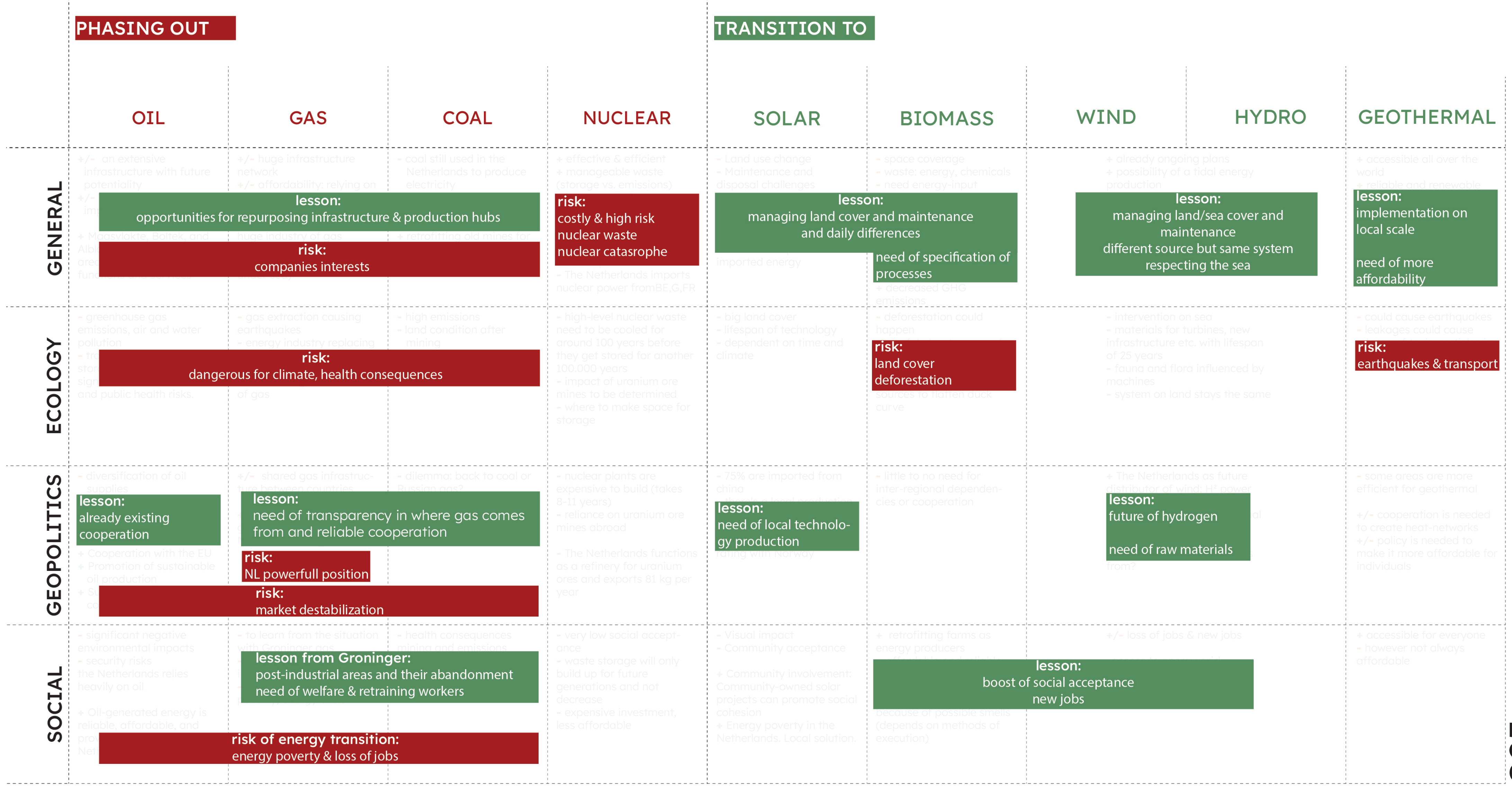


Figure 13

WHAT & WHO

GEOPOLITICS ANALYSIS:

Policy framework

Geopolitical dependencies are a point of great importance in regional planning. Energy transition requires cooperation on an international scale given the diversity of resources, infrastructure and demand. Therefore, it is important to consider the political framework. Given that changes in the energy industry are an already widely known topic, we have included current policies that will be relevant to the project.

Internationally, an important document is the IPCC Special Report on Impacts of Global Warming of 1.5° C. The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change and for advising governments on how to prevent climate catastrophe (IPCC, 2022). The aforementioned report includes such recommendations as changing behaviours of energy consumption, managing investments wisely, and investing in electrification. Goals set by this document have a deadline to cut greenhouse gas emissions to as close to zero as possible by 2050.

For countries belonging to the European Union, an important document is the The European Green deal. It presents a roadmap for making the EU's economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all. In this document, a great deal of weight is given to international integration and strong grid, combating energy poverty and the enormity of investment in offshore energy (Fetting, 2020). Which signals the need to plan in harmony with nature also at sea. However, the European Union already has a body in charge of these issues. The North Seas Energy Cooperation (NSEC) supports and facilitates the development of the offshore grid development and the large renewable energy potential in the region.

Other documents and plans are: REPowerEU Corridors, Delta corridor plans, European Hydrogen Backbone. It is important to consider the current plans for the project areas, especially those planned locally with participation, as they have the potential to strengthen the overall network.

IPCC

- Rapid and profound near-term **decarbonisation of energy supply**
- Greater mitigation efforts on **the demand side**
- Switching **from fossil fuels to electricity** in end-use sectors
- Considerable shifts in investment patterns

EU Green Deal

- **interconnected energy systems**
- **innovative technologies**
- help EU countries to **tackle energy poverty**
- the full potential of Europe's **offshore wind** energy

The North Seas Energy Cooperation

- a Joint Statement **to reach at least 260GW of offshore wind energy by 2050**

International cooperations

- EU-UK Trade and Cooperation Agreement
- REPowerEU Corridors
- Delta corridor plans
- European Hydrogen Backbone

GEOPOLITICS ANALYSIS:

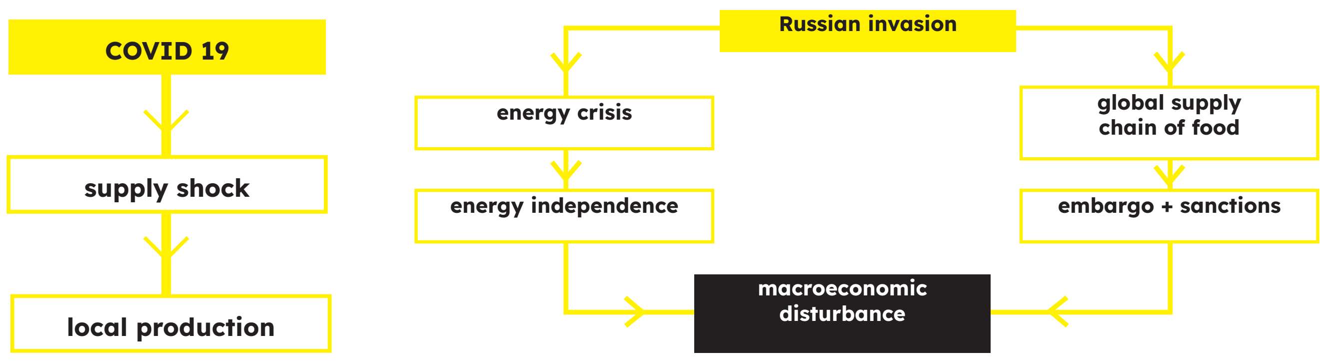
Deglobalisation

Recent events like COVID-19 and the Russian invasion in Ukraine has caused a supply shock and the global supply chain appears more costly than regional productions (ESPON IRiE, 2022b). COVID-19 illuminates the fragility of the global supply chain and the interdependence of our current economy. Local production appears more attractive for business in the aftermath. Countries who depend on Russian oil and gas are being forced to look for alternative supplies as Russia uses these dependencies as leverage in war (ESPON IRiE, 2022a). This has caused an energy crisis and left countries to debate their dependencies. Can we be independent and is it worth it?

The current global value chain has developed so that no region can be fully independent (McKinsey & Company, 2022). The globalisation process cannot be fully reversed and we will continue to depend on each other in the future economy. So, the question is rather: How much should we depend on others?

This project explores these boundaries within the region of North-West Europe. By strengthening the European network and shortening the supply chain, the future uncertainties become more predictable and manageable. However, this requires new spatial policies which determine regional potentials, competencies and their connection (ESPON IRiE, 2022a), which this project will also explore.

Looking at these developments and the x-curve, the energy crisis is currently near the chaos phase. However, this provides also a better opportunity to transition towards renewables now as inflation and other recent events drive energy prices of fossil fuels to the roof (NOS, 2022). Renewable energy is no longer expensive and unprofitable. We need an energy transition, and now is the time to do it.



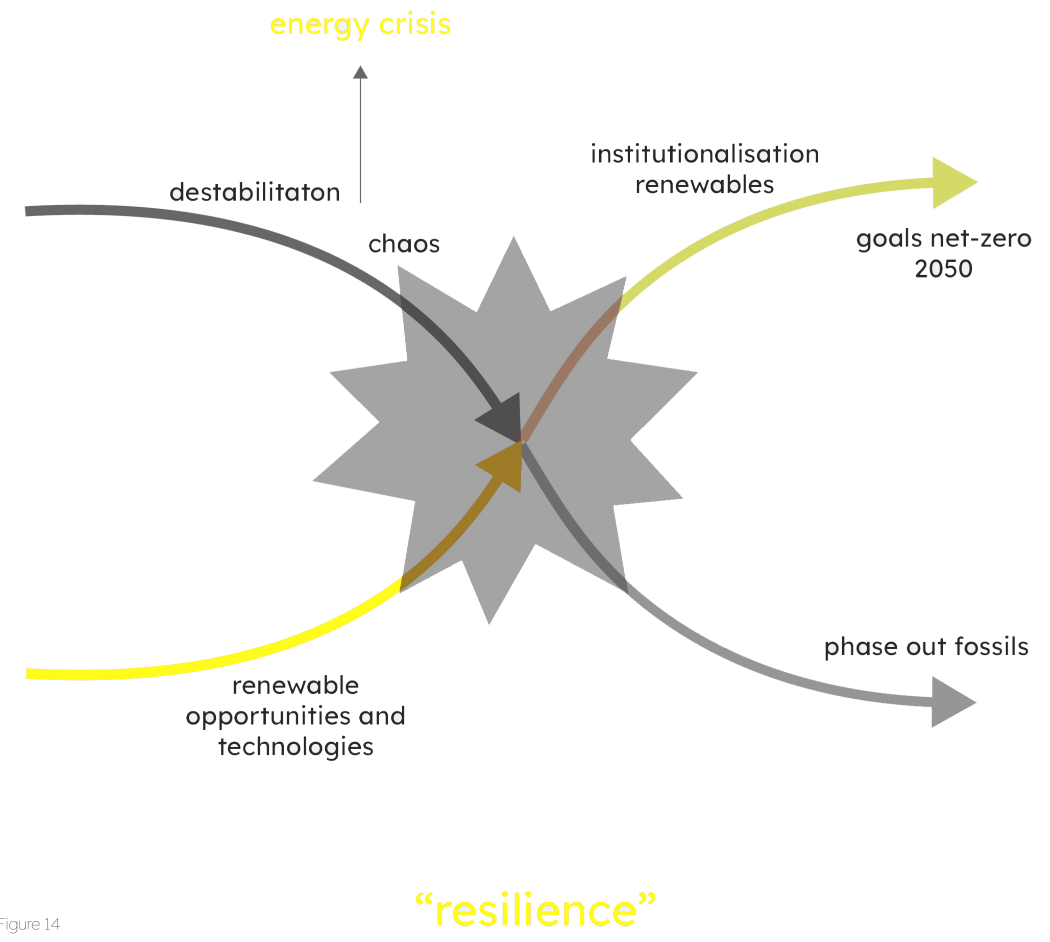


Figure 14

WHAT & WHO

GEOPOLITICS ANALYSIS:

Energy trade & relationships

This report includes the trade and flow analysis of energy sources between countries in the region of North-West Europe. It revealed strong dependencies of those countries on resources from the United States of America, Russia or Norway, that now are in process of phasing out. Table nr 16 includes each country's main energy sources, countries resources, needed or ongoing transitions, dependencies, European Union demands and conflicts.

While analysing international relationships it became obvious how unequal resources, quality of infrastructure or level of technological progress is. It is also obvious that many countries rely on each other and play an important role in the economy of another country. To create an international resilient energy network, integration of the grid is needed and stronger relationships built on trust. To make transition just, countries that do not have enough resources for change should be taken into account and supported by leading countries. Our project aims to create an European resilient system of energy trade and infrastructure that will allow for less transportation, lower emissions and self sufficiency.

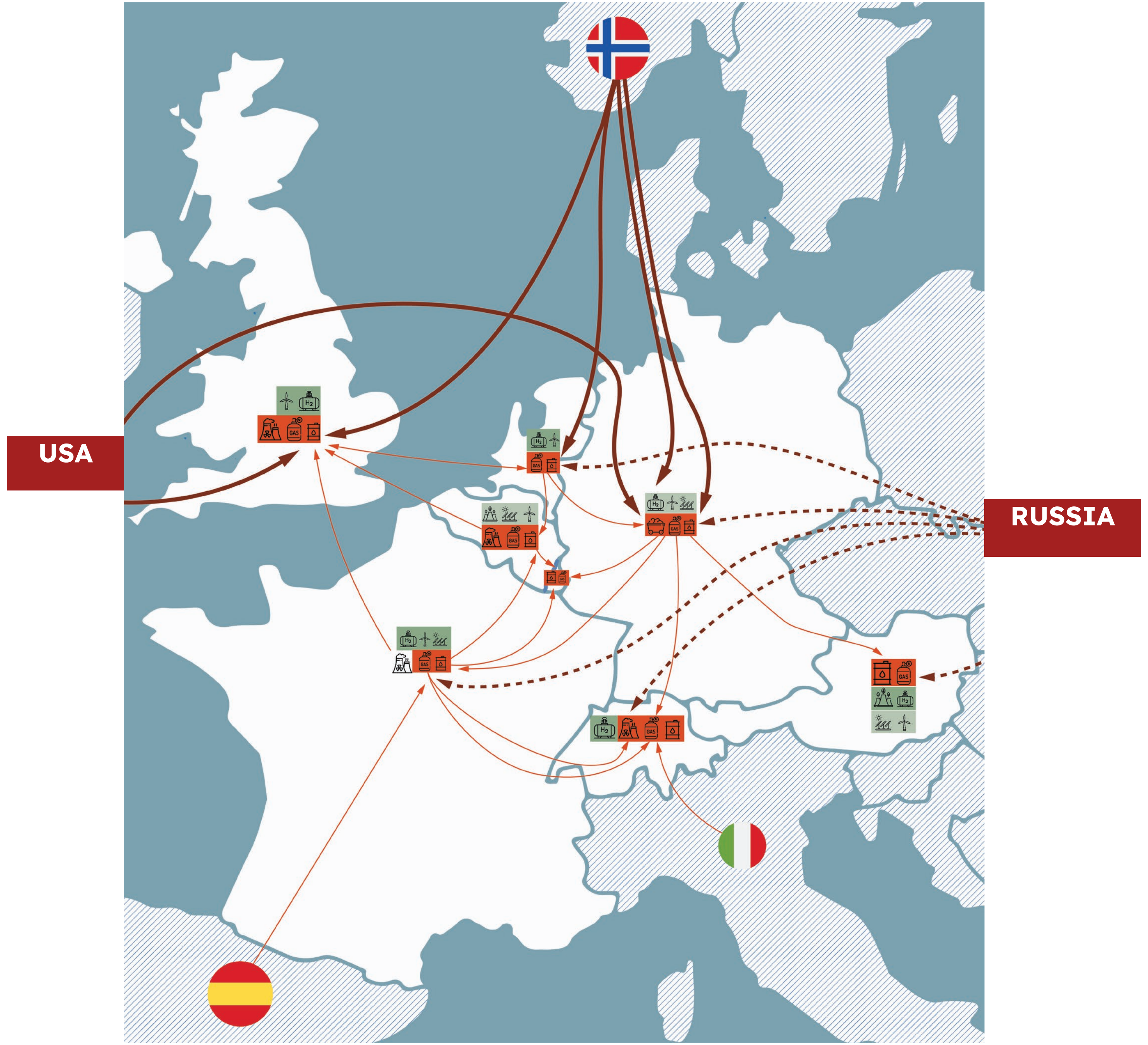


Figure 15

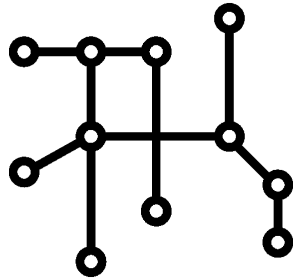
							NO EU	
MAIN ENERGY SOURCE	fossil fuels, with coal and natural gas being the primary sources	fnatural gas and renewable energy	nuclear and renewable energy	nuclear, natural gas, and renewable energy	main energy sources are oil, natural gas, and electricity	natural gas, followed by oil and renewable energy sources such as hydropower and biomass	are natural gas, nuclear, and renewable energy	hydroelectricity, nuclear energy, and fossil fuels (oil and natural gas)
COUNTRY RESOURCES	does not have significant domestic energy resources and therefore relies heavily on energy imports	-was one of the largest natural gas producers in Europe, with the Groningen gas field being the largest gas field in Europe (phasing out)	-significant nuclear energy industry -has some domestic oil and gas reserves, but they are limited	- has two nuclear power plants that provide a significant portion of its electricity -limited domestic production.	does not have significant energy resources within its own borders, so the country relies heavily on energy imports	has limited domestic energy resources, but it has abundant water resources that are used to generate hydropower	limited domestic energy resources, with only small oil and gas reserves	has a significant number of hydroelectric power plants that provide most of its electricity. Has five nuclear reactors that contribute to its energy mix
TRANSITIONS	to wind, solar, and hydropower, aims to phase out nuclear power by 2022 and to achieve a fully renewable energy system by 2050	-aims to reduce its greenhouse gas emissions by 49% by 2030 and to achieve a net-zero carbon economy by 2050. - increasing the share of renewable energy sources in its energy mix to 16% by 2023 and 70% by 2050.	aims to reduce its greenhouse gas emissions by 40% by 2030 and to reach carbon neutrality by 2050 -increasing the share of renewable energy sources in its energy mix to 33% by 2030	- to transition to a low-carbon economy and reduce greenhouse gas emissions by 80% by 2050 compared to 2005 levels. The country has set a goal of phasing out nuclear energy by 2025 and increasing the share of renewable energy in its energy mix.	Luxembourg has set a goal to transition to a low-carbon energy system, with a focus on increasing the share of renewable energy in its energy mix. The country aims to achieve a carbon-neutral economy by 2050.	Austria aims to achieve a carbon-neutral economy by 2040, with a focus on expanding renewable energy sources and energy efficiency measures.	UK aims to reach net-zero carbon emissions by 2050, which requires a significant increase in the use of renewable energy and a decrease in the use of fossil fuels. The UK government has set a target of generating at least 40GW of offshore wind by 2030, which would require significant investment in the development of wind farms.	aims to transition to a low-carbon economy and phase out nuclear energy by 2035. The country plans to increase the share of renewable energy in its energy mix and improve energy efficiency
DEPENDENCIES	-renewable energy=domestic production -imports of hydropower from countries like Norway. - natural gas from countries such as Russia, Norway, and the Netherlands. - coal, with the largest suppliers being Russia, Colombia, and the United States. (Russia as largest suplier)	- imports for most of its energy, including natural gas imports from Russia and Norway The country also imports oil from countries such as Russia and the United Kingdom.	-imports for most of its oil and gas needs, with Russia -some electricity from neighboring countries such as Germany and Spain	depends on imports for most of its energy needs, including oil, natural gas, and coal (the Netherlands and France)	The country's main energy sources are oil, natural gas, and electricity, which are primarily imported from neighboring countries such as Germany, Belgium, and France.	highly dependent on natural gas imports from Russia, which account for more than half of its natural gas supply. It also imports oil from various countries.	depends on imports for most of its oil and gas needs, with Norway being the largest supplier of natural gas and the United States being the largest supplier of crude oil. The country also imports some electricity from France, Belgium, and the Netherlands.	- oil and natural gas from neighboring countries such as Germany, Italy, and France. - nuclear fuel, Switzerland relies on foreign suppliers such as France and Russia for the fuel required by its nuclear reactors
EU DEMANDS & INTERNAL CONFLICTS	The European Union expects Germany to lead the way in the energy transition and to continue to increase the share of renewable energy in their energy mix	- to continue to increase the share of renewable energy in its energy mix and to meet its emissions reduction targets	to continue to work towards its emissions reduction goals and to increase the share of renewable energy in its energy mix	to continue to work towards its emissions reduction goals and to increase the share of renewable energy in its energy mix	to contribute to the bloc's energy transition goals, reducing greenhouse gas emissions, and improving energy efficiency.	continue to increase its use of renewable energy sources and improve energy efficiency, in line with the bloc's goals.	Since leaving the EU, the UK has set its own targets and policies for energy transition, but it remains an important partner for the EU in areas such as energy trading and interconnectivity.	Switzerland is not a member of the European Union, but it participates in the EU's energy market through bilateral agreements.

Figure 16

WHAT & WHO

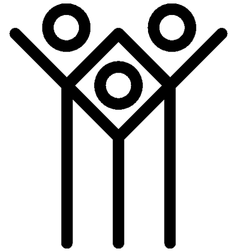
SOCIAL DILEMMAS

According to data from the International Energy Agency (IEA), energy prices have been experiencing an upward trend globally. Notably, in comparison to OECD countries, non-OECD countries have experienced an average energy cost that is 70% lower. Additionally, the regions with the highest energy prices are Europe and Asia. Over the last decade, energy prices in Europe have increased by 25%, as per the Energy Price Index (2021). Even though the European Union (EU) has set ambitious targets for reducing greenhouse gas emissions, it still increased its final energy consumption by 0.2% in 2020, and most of its energy still comes from fossil fuels (Eurostat, 2021a). The Energy Dashboard developed by the EU shows that 74% of the energy consumed in 2021 by the EU27 came from non-renewable sources (Eurostat, 2021b).



Affordability

Transitioning to renewable energy sources may result in higher energy prices for consumers, which could lead to energy poverty, a situation of limited access to affordable and reliable energy, particularly affecting underprivileged communities. This is a critical issue that needs to be addressed as part of the transition to sustainable energy systems. While addressing the affordability and accessibility of renewable energy, policymakers need to ensure that marginalised communities are not disproportionately burdened during the energy transition, prioritising social justice and equity (IEA, 2021; Energy Price Index, 2021; Eurostat, 2021a, 2021b).



Accessbility

The welfare of the Netherlands, Belgium, and Germany is facing significant social dilemmas, according to data from the Centraal Bureau voor de Statistiek (CBS). The poverty rates in the Netherlands have increased, with over 600,000 people, including children, living below the poverty line (CBS, n.d.). Belgium is also grappling with poverty, with about 15% of the population living below the poverty line (Statbel, 2021). Although Germany has a relatively low poverty rate, social inequality concerns still exist, particularly in education and employment accessibility (Destatis, 2021).

Acceptance

The energy transition could reduce social inequalities, particularly for marginalised communities without access to affordable renewable energy, while certain communities could benefit more than others. Therefore, it's crucial to prioritise social justice and equity, focus on mitigating the risk of energy poverty, and ensure community involvement in decision-making regarding renewable energy projects (Smith et al., 2020 ; International Renewable Energy Agency, 2019). In conclusion, the energy transition presents several social dilemmas that need to be addressed to ensure a just and equitable transition. By prioritising social justice and equity and addressing concerns about affordability, accessibility, and social acceptance, the energy transition can become more sustainable and successful.

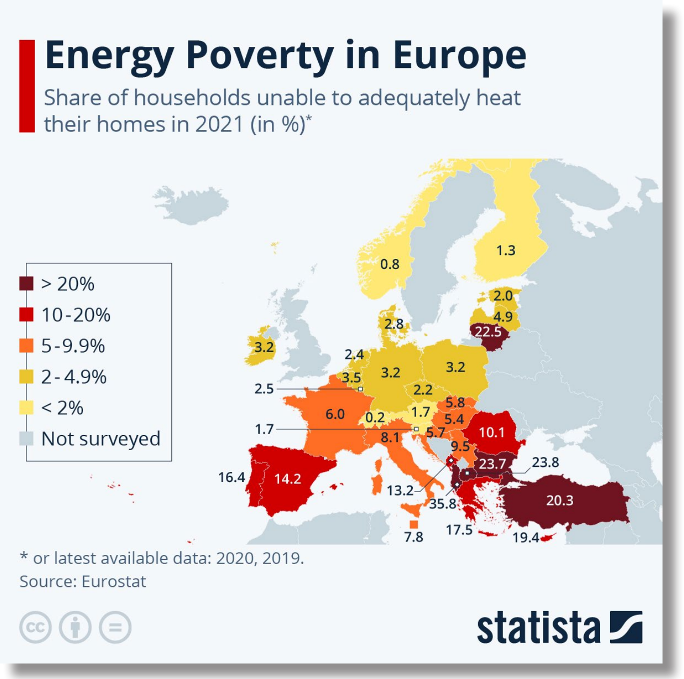


Figure 17

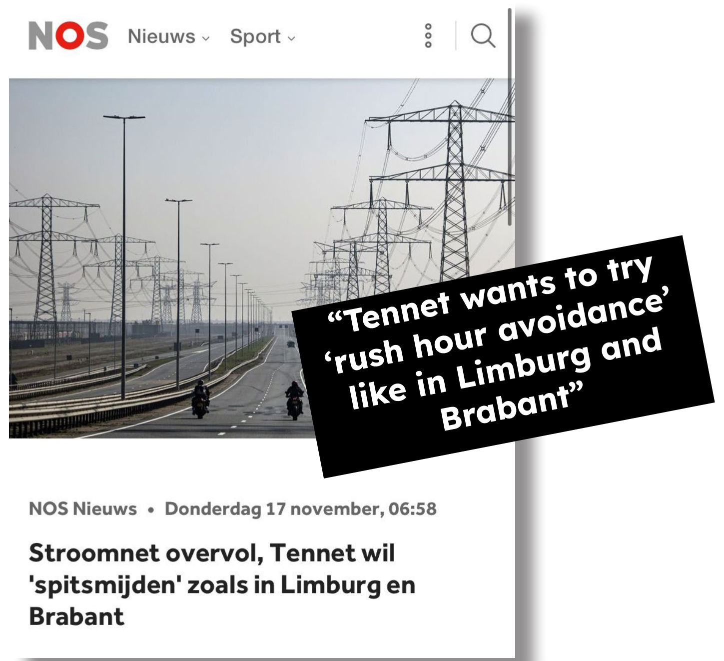


Figure 18

Figure 19

Figure 20

Figure 21

WHAT & WHO

SPATIAL DILEMMAS

On the L-scale (BE-NL-DE), analysis of the existing energy system of fossil fuels, protected nature areas, land use types were concluded in the following:
The mapping of the gas, oil and coal system shows a well-connected, optimised system. There is still a lot of mining, refining and distribution of oil around Rotterdam and Antwerp, gas around Groningen and in the North sea and of coal in the Ruhr area. The network for fossil fuels is international, with oil connections in between highly industrialised areas and gas connections all throughout Europe and also crossing the North sea.

The mapping of the electricity network mainly reveals the many power plants running on fossil fuels. This shows that the current goal of rapid electrification does not imply that we become less dependent on fossil fuels. The Netherlands, for example, have not been mining coal for centuries, but we still use imported coal to generate electricity (Aenert, n.d.).

These maps together present an optimised, spacious energy system, revealing existing hubs of refinement, production and distribution of energy. Additionally, we can see a lot of energy related functions pushed to the borders of countries, especially nuclear plants. A reason for this might be that we preferably do not want these functions in the landscapes we live in, on the other hand there is more space for living together and cooperating near the borders.

Mapping the protected nature areas and energy system together shows the spatial pressure on nature, especially protected areas close to the agglomerations. Combined with the agriculture areas, city tissue, transportation zones and production sites at sea the general issue of a lack of space becomes clear. This demands a different approach in renewable energy production, as this takes up a lot of space, for example multifunctional energy production landscapes.

Fossil fuels infrastructure

Figure 22

Electric infrastructure

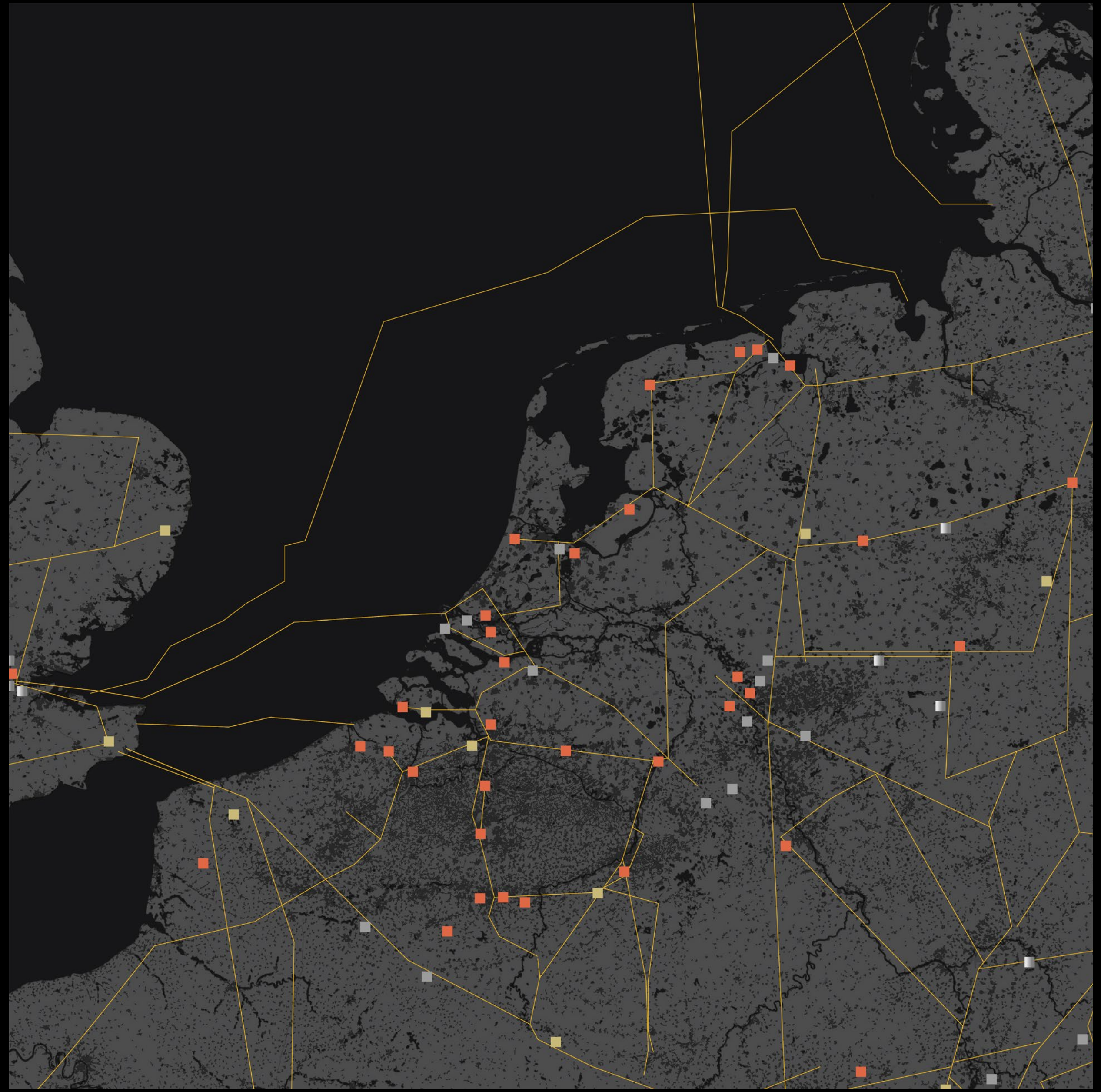


Figure 23

Legend

- Coal power plant (over 100 MW)
- Gas power plants (over 500MW)
- Nuclear power plant
- Combined power plant

- Main electricity line

- Crude oil pipeline
- Oil products pipeline
- Natural gas pipeline

- Oil extraction
- Natural gas extraction
- Coal mines

- Oil refinery
- Natural gas processing plants

- Natural gas storage
- Oil storage

- Oil terminal
- LNG import terminal

0 50 100km

Land & sea cover

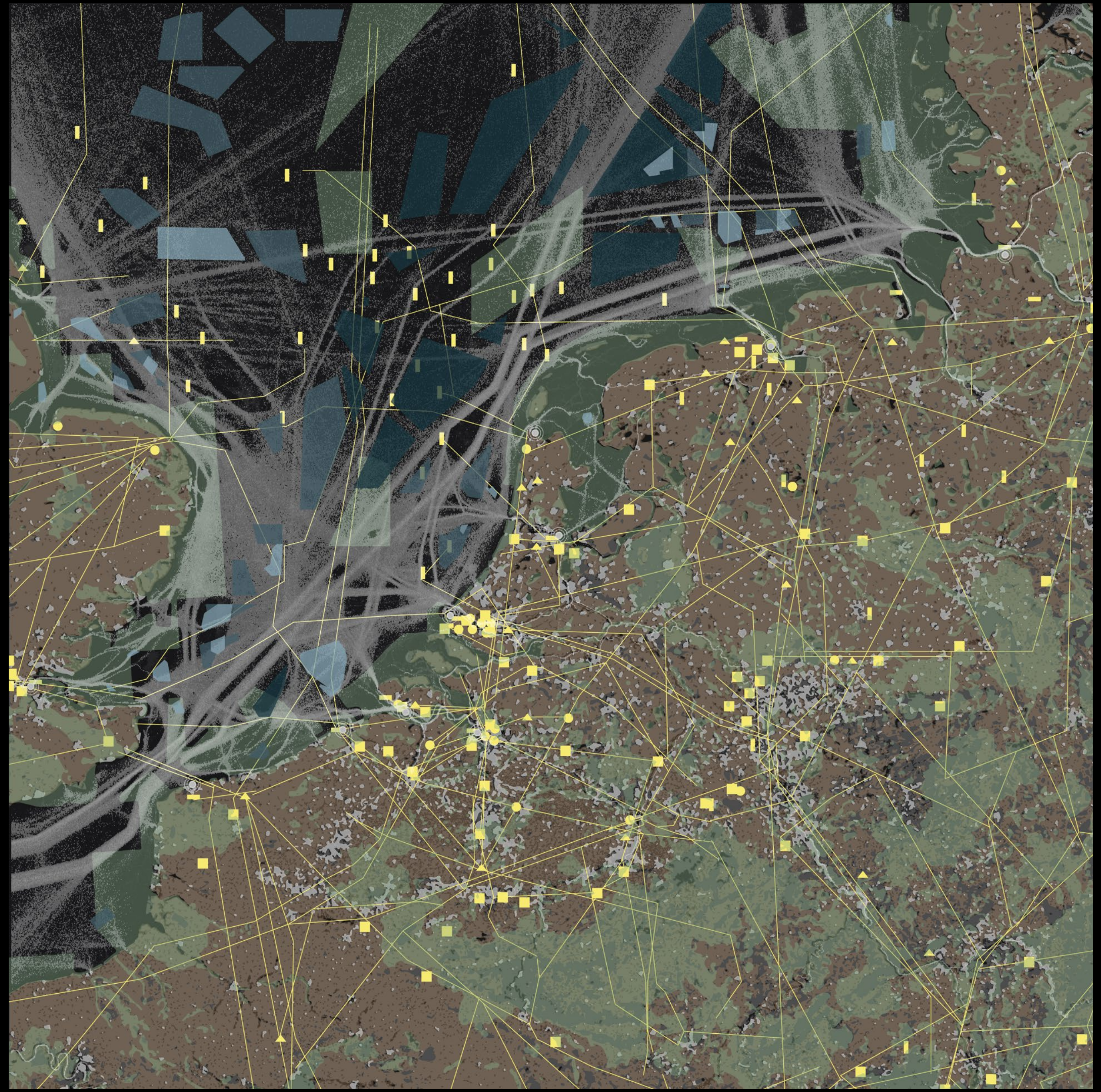


Figure 24

Legend

- fossil fuel industry
- network: gas, oil, electricity
- protected natural areas
- Agglomeration
- Agriculture (corine land cover)

- Martine traffic (busy to no boats)
- Ports

- Windparks
- Under development/planning windparks
- Search areas for windparks

0 50 100km

SPATIAL DILEMMAS

After the research of the existing energy system of fossil fuels, protected nature areas, land use types, we can map the potentials of the area. Both the industry sites and the network in the current fossil energy system can be reused. This way it won't be necessary to create new infrastructure or expand the network into nature areas. Current energy hubs are heavily dependent on fossil fuels, which presents a risk of being left-behind in a renewable future. Retrofitting the current energy system for renewables automatically means that these areas will be included. These hubs are also already well-connected. Strong connections can also make the need for some forms of transport less. For example restricted movement at sea in combination with strong lasting connections like hydrogen pipes and electricity cables, presenting an opportunity to even expand and connect nature areas. In a strongly connected network, there is also room for specialisation, looking at the natural potential (of wind, solar, geothermal and biomass energy) at a place. The energy production that is pushed to the borders present an opportunity to make these connections also stronger across borders. These border areas can share storage and production between countries and even contribute to creating a resilient network where countries can rely on each other's hubs of expertise when necessary.

Legend: risk and potential

- (Industrial) Areas heavily dependend on oil
- (Industrial) Areas heavily dependend on gas
- (Industrial) Areas heavily dependend on coal
- Hubs of energy industry

- Gas/Oil/Electricity main network
- Country borders

- Excess heat from industry (40-30-15-<5 PJ/a) (not from power plants)
- Excess heatwastewater treatment biggest
- Potential wind energy areas (600-1000 W/m2 at 100m height) on land
- Existing wind farms at sea
- Areas with highest geothermal potential
- Surface water excess heat potential

- Protected nature areas
- Agglomerations

0 50 100km

Map of potential & risk

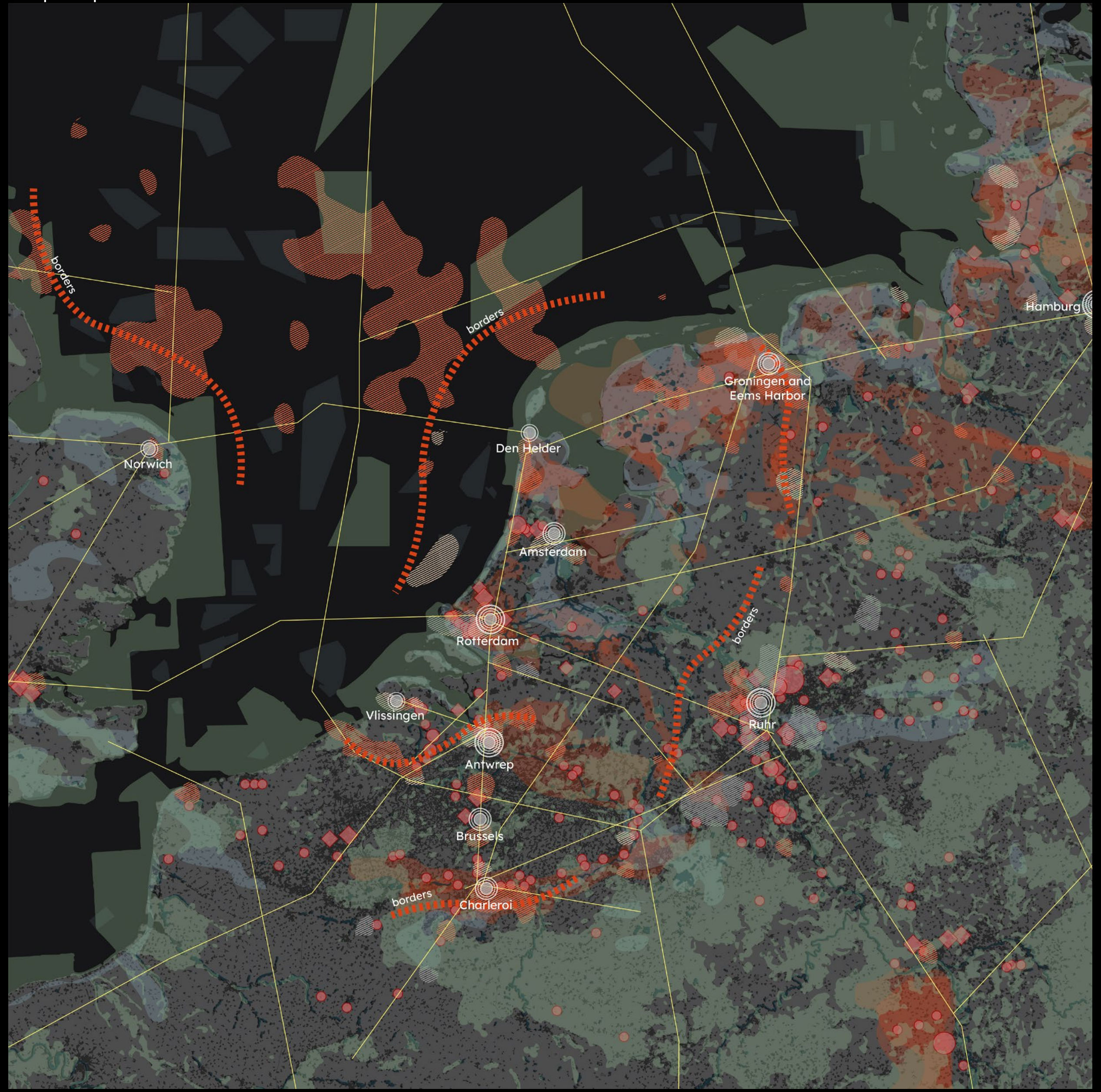


Figure 25

Landscape

At the very beginning of the third quarter of the MSc Urbanism curriculum, we made an excursion to the areas of Rotterdam port, Green heart around Rotterdam city and Westland. This experience gave us an important impression and feeling of the energy production land. Looking for the famous vast we faced a certain disappointment. The presence of energy infrastructure in our spaces became striking. Accepted or more often ignored it is always in the background of our view. With transition to renewable resources that issue will become only bigger. Nature inclusive development and infrastructure will be essential for the future. This collage presents a reflection of this excursion and experience.

Photos made by Arjanne van der Padt

WHAT & WHO

HUBS ANALYSIS

From the spatial analysis, a few hubs can be located where energy infrastructures, agglomerations and nature elements come together. These hubs are important nodes within the energy network of North-West Europe and cross-border connections between The Netherlands, Germany, Belgium and the United Kingdom. Figure 27 shows the characteristics of these hubs: whether the hubs are shrinking or growing depending on the number of employees and their annual revenue; the spatial character of the hubs, the ports' (red) relationship with the city (black); their job capacity; their main trade or function and the important partners.

Some general conclusions can be extracted from this table:
The port of Rotterdam and Antwerp are both important in Europe's connection with the rest of the world. As both will continue to grow in the future, it is important to take into account the spatial and social justice in the expansion of the ports.

As gas and oil platforms on sea will gradually lose their current function due to the energy transition, Den Helder will have an important role in managing the retrofitting and/or dismantlement of these platforms.

The port of Groningen produces one thirds of the Netherlands energy (Groningen Seaports, 2023) and will inevitably be an important stakeholder in the energy transition.
The Ruhr-area in Germany has gone through a historical transition from their well known coal industry to now a knowledge and tech-based industry. They can be an example for other areas at the starting point of transitioning and become a knowledge hub for North-West Europe.

The oil and gas pipelines from the North Sea to the UK are currently entering in Norwich, from which they spread out into the UK. In the future, if collaborations between EU and the UK strengthen, Norwich will become an important node in their connection. The growth of this area is both socially and spatially important.

	PORT of ROTTERDAM	DEN HELDER	AMSTERDAM	NORTH SEA PORT (Vlissingen - Gent)	GRONINGEN (Delfzijl, Eemshaven)	RUHR AREA	HAMBURG	ANTWERP	BRUSSELS (+ SURROUNDINGS)	NORWICH (UK, potential port)
GROWTH/ SHRINKAGE jobs and revenue										
CHARACTER spatial										
SOCIAL demographics	**100.500** employees **565.000** job capacity in NL	**2.824** employees **2.753** indirect employees	**20.713** employees **14.131** indirect employees	**102.000** employees	**6.870** employees **6.109** indirect employees	**5,3 million** inhabitants Social-Economic division	**156.000** employees **267.000** job capacity in Germany	**433.833** job capacity in BE	**9.000** job capacity in BE	**144.000** inhabitants
INDUSTRIES dependencies	• Iron ore & Metal scraps • Coal • Raw natural oil & oil products • Europe • America • Asia • Port of future hydrogen network	• **99%** North Sea oil & gas platforms • Plug & Abadonement Project • Off-shore wind	• Raw natural oil & oil products • Coal • Europe	• Grain (dry bulk 51%) • Steel (nr. 1 breakbulk port in Europe) • Port of future hydrogen network • Europe • **Russia** • America	• Datacenters • Energy port Off-shore wind • Chemical industry	• Culture & Knowledge based economy (tourism & universities) • Derelict industries • Technology & Service industry	• Railway port • Ores, oil products & coal import • Agri bulk export • China • America • Europe	• Biggest chemical cluster of Europe • On-shore wind • Energy port • Europe • America • Asia	• Construction materials • Oil products • Agri bulk • Netherlands • Germany	• Existing pipelines • Future North Sea Energy plans

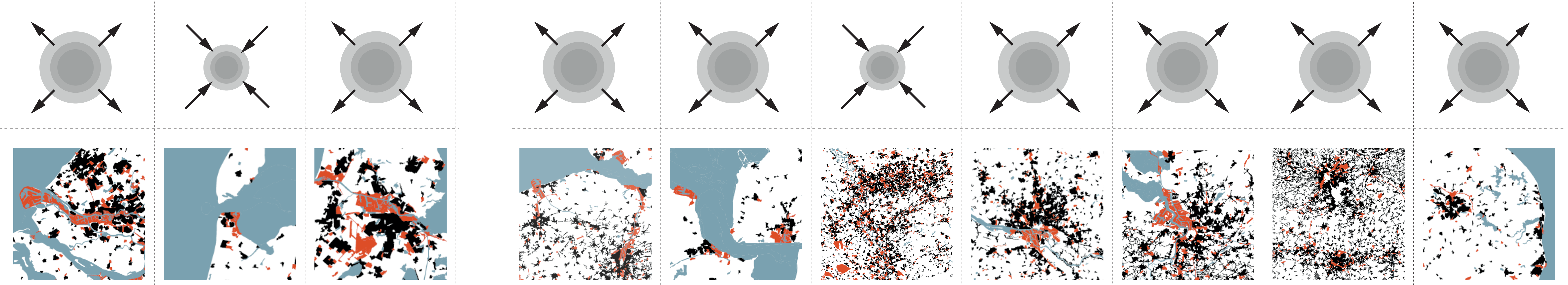


Figure 27

WHERE TO?

Vision statement

'Projected CO2 emissions from existing fossil fuel infrastructure without additional abatement would exceed the remaining carbon budget for 1.5°C (50%) (high confidence).' (IPCC, 2023)

The fact that we can no longer wait quietly for change cannot resound louder. In our project we aim to address social and spatial justice and resilience in the energy transition, by rethinking and redesigning the status quo energy systems, including industry, infrastructure and international collaboration.

Nature is a highly respected actor in any action we make. Spatial analysis uncovered the emergency of ecological areas protection on both land and sea, which we also expand and connect in our vision of the future. Energy industry based on renewable resources covers a significantly bigger area than one based on fossil fuels and gas.

Therefore our project aims for spatial justice. That means to plan in a sustainable way, to use as little space as possible, fairly allocate goods, retrofit existing industries and infrastructure. In the future, energy landscapes will be multifunctional.

As the future environment might be more unpredictable, we are in need of resilient networks. This means a future based on stronger and reliable internal cooperation in Europe.

Our project identifies cross-borders regions that have opportunities for renewable energy transition, but also regions that are at risk of being left behind. With this knowledge we plan interrelated hubs which use their context specific potential in the best possible way. In order to create this resilient energy network, there is a need to strengthen the existing grid and improve missing links in order to minimise transportation, emissions as well as storage.

Lastly, for energy transition to be truly sustainable it needs to be just and inclusive.

Through analysis, we can identify communities at risk and areas of energy poverty. Existence of main hubs that act as leaders will be supporters of those less progressive areas. Additionally with welfare policies, retraining workers, educating citizens and including them in local planning through pattern language tool we reach a safe and inclusive energy transition.

To achieve vision goals we will operate in our conceptual framework based on a circular and regenerating economy. Starting with 'Repurpose industry and infrastructure' through 'Reduce energy use', 'Rethink energy system and lifestyle', 'Refuse non-renewable resources', 'Revitalise ecology and community', 'Renew energy' and ending with 'Restore trust and ecology' we aim to reach a resilient and just future.

Figure 28

Vision

Revitalise & Restore:
Ecology, Community & Trust

The vision of "the Power of justice" can be understood in terms of the R-ladder. Firstly, we need to Refuse fossil fuels, Reduce energy use and Renew energy sources. In Revitalising and Restoring ecology, community and trust, nature areas will be connected, expanded and invited. Additionally, there will be cross-border collaborations in border areas. With a certain decentralisation and centralisation comes a social boost in at-risk areas in hubs and rural spaces. Repurposing and rethinking the infrastructure and industry includes renewable energy connections in between hubs of for example hydrogen and biofuel, and restricted sea traffic. Hubs are specialised according to their context, for example the potential for renewable energy production in their surroundings or their past function in the fossil system. Simultaneously, the hubs have a general function of seasonal energy storage (mostly storing hydrogen) and energy conversion. In conclusion, rethinking the energy system leads to a just and resilient energy network in 2050.

Legend: Vision Map

- Energy hub
- Area of energy hub
- Areas getting a social boost
- Expanded protected natural areas
- International cooperation and trust
- Area of geothermal heat production
- Area of concentrated biomass production
- Area of on-shore windfarms
- Area of production at sea (wind-hydrogen)
- Area of concentrated solar field
- Hydrogen network
- Biofuel network
- Hydrogen storage (old gas storage)
- Water highway
- Possibility for integration in main grid
- Solar fields
- Heat network (geothermal an excess heat)
- Storage of energy
- Conversion of energy
- Point of passing through/trade
- Mananging role
- Windpark
- Hydrogen hub
- Biomass to energy
- Nature inclusive development
- Regional importance
- International importance
- Knowledge hub
- Political importance
- Energy tourism
- Living/cultural significance
- Community involvement
- Food hub

Vision

Repurpose & Rethink:
Infrastructure & Industry

Legend: Vision Map

- Energy hub
- Area of energy hub
- Areas getting a social boost
- Expanded protected natural areas
- International cooperation and trust
- Area of geothermal heat production
- Area of concentrated biomass production
- Area of on-shore windfarms
- Area of production at sea (wind-hydrogen)
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- Hydrogen network
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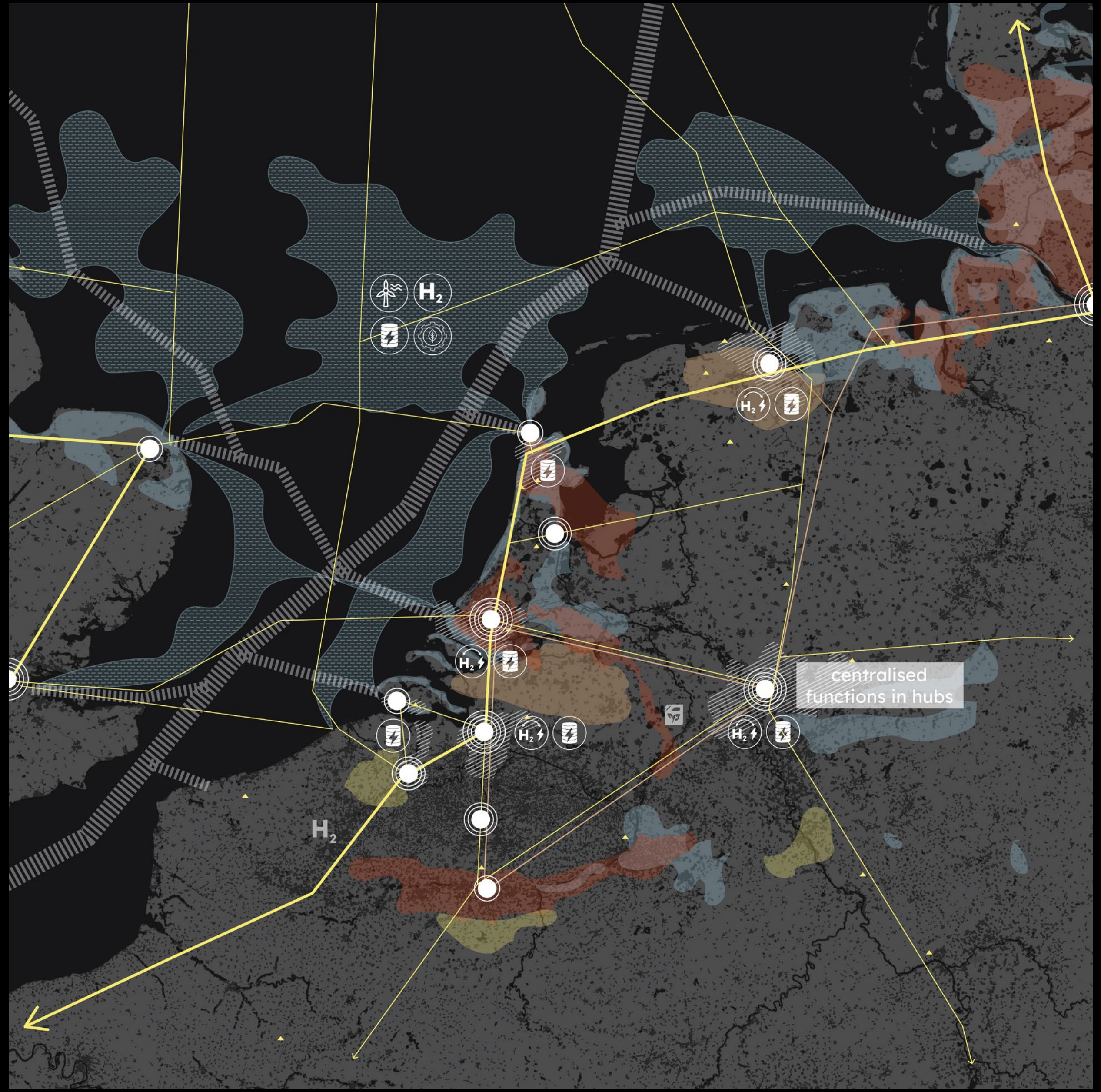
- Biomass to energy
- Nature inclusive development
- Regional importance
- International importance
- Knowledge hub
- Political importance
- Energy tourism
- Living/cultural significance
- Community involvement
- Food hub



0 50 100km

Figure 29

Vision

Rethink: 2050 Just
& Resilient Energy Network

Legend: Vision Map

- Energy hub
- Area of energy hub
- Areas getting a social boost
- Expanded protected natural areas
- International cooperation and trust
- Area of geothermal heat production
- Area of concentrated biomass production
- Area of on-shore windfarms
- Area of production at sea (wind-hydrogen)
- Area of concentrated solar field
- Hydrogen network
- Biofuel network
- Hydrogen storage (old gas storage)
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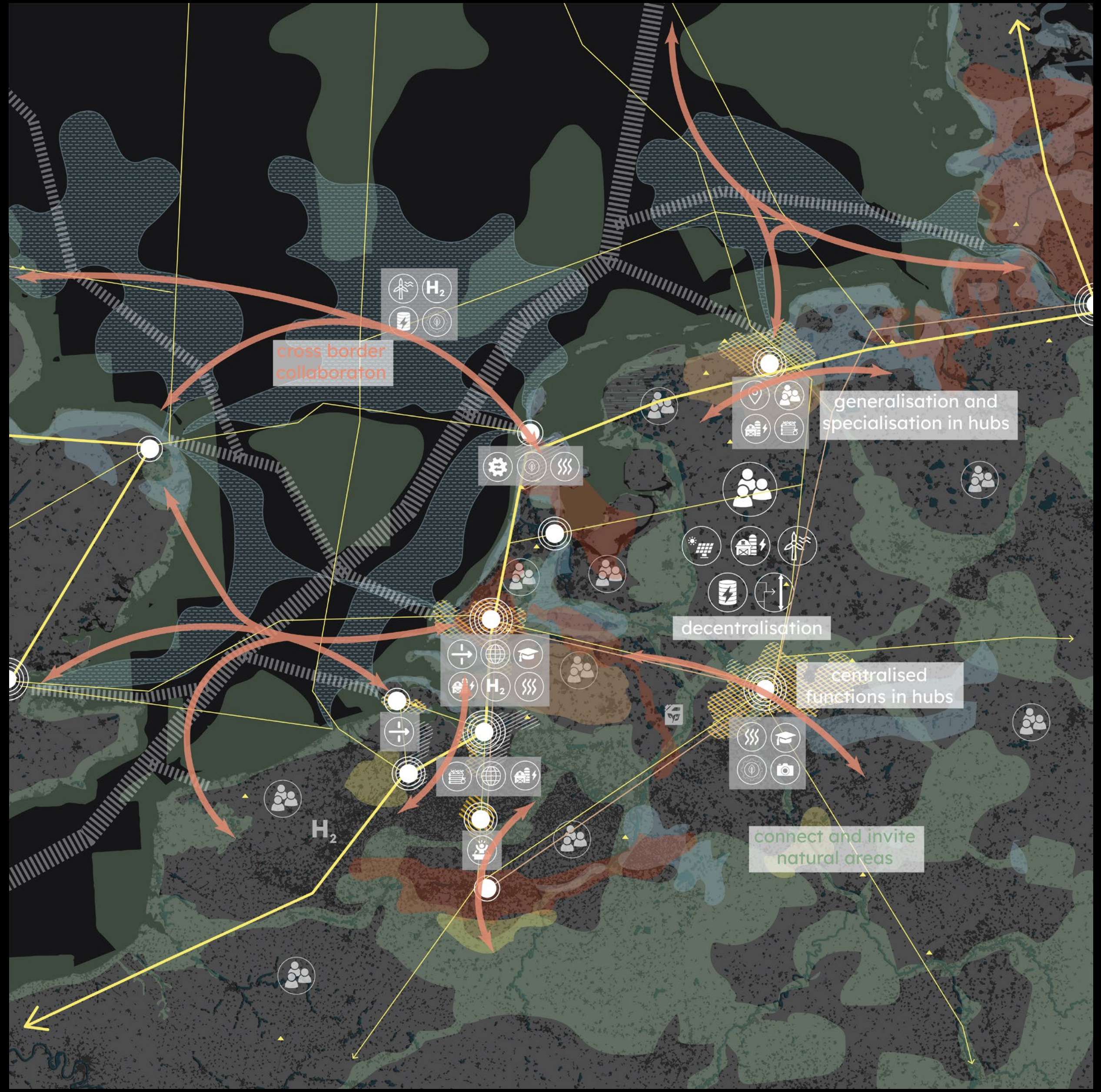
- Energy tourism
- Living/cultural significance
- Community involvement
- Food hub



0 50 100km

Figure 30

WHERE TO?

Vision

Analysis shows the scarcity of space for energy production. Therefore, new energy landscapes are mixed-use. On sea, wind energy production areas should be nature inclusive. To reduce transport and thereby energy use, the production of hydrogen from wind energy should also be on sea. Herefore, abandoned oil and gas platforms can be retrofitted. Industries in the port can be given a new function, either as energy storage or a renewable energy production site. Agricultural land, instead of being left out by policies, can be retrofitted to an energy production landscape. Biomass can be produced there and locally transformed into biofuel, -gas or -coal. The urban area should become a landscape of individual and collective energy production, where residents can produce their energy on their roofs for example. The new energy system wastes less energy on transportation and transformation of energy forms; is nature-inclusive where possible; and respects boundaries of nature while mixing in with current land-use.

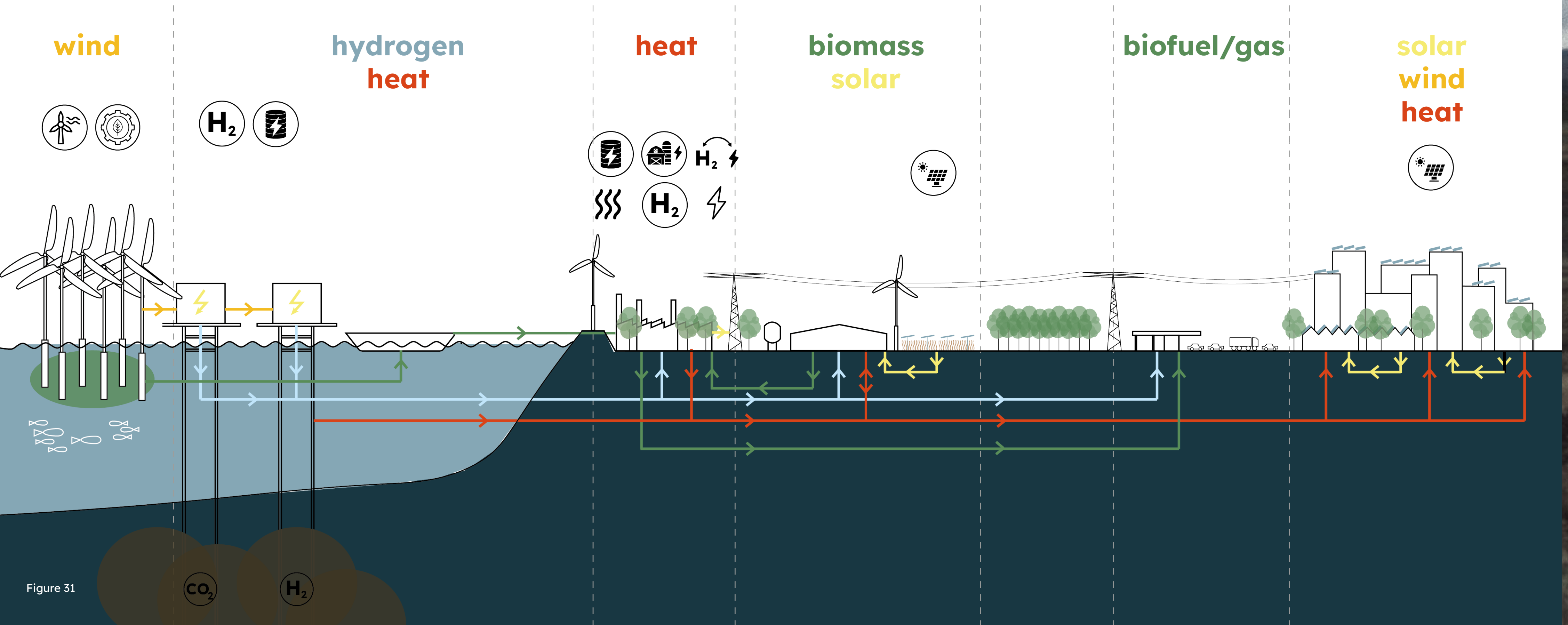


Figure 31

The artwork envisions a resilient and equitable future where energy landscapes are not solely utilitarian spaces filled with technical objects striving to extract maximum energy. Rather, they are harmoniously integrated into natural landscapes, such as polders, swamps, and non-urban areas, that thrive and function as social spaces, promoting a deeper connection with nature and raising awareness about the future we aspire to achieve. Through a spatial planning lens, this artwork challenges us to reimagine the energy landscape as an integral component of a sustainable and just future.

Figure 32

Figure 33

WHERE TO?

Vision summary

Secured geopolitical relationships: the need for strong international relationships and collaboration to ensure the transition to renewable energy is successful. This involves building trust and cooperation between countries, especially in terms of energy policies and resource sharing

Affordable, accessible, and fair distributed energy: to ensure that renewable energy is affordable, accessible, and distributed fairly to everyone, regardless of income or location. This is important to ensure everyone has access to clean and sustainable energy, which is essential for a sustainable future.

Regenerated ecology: there's a need to regenerate and restore the natural environment that has been damaged by past energy practices. This includes the restoration of ecosystems, biodiversity, and the promotion of sustainable agriculture practices.

Strong geopolitical relationships and improved energy grid: strengthen international relationships while improving the energy grid infrastructure to support the transition to renewable energy sources.

A comprehensive approach that takes into account the challenges posed by geopolitics, lack of space, social justice and equity, and ecological concerns: there's a need for a holistic approach that considers the various challenges and constraints that the energy transition faces, including geopolitical, social, and environmental

The transition towards renewable energy sources: to shift away from fossil fuels and other non-renewable energy sources and transition towards sustainable, renewable energy sources such as wind, solar, hydro, and geothermal power.

Better spatial planning in terms of land use: To maximise the use of renewable energy sources, the project advocates for better spatial planning of land use to optimise energy production from renewable sources.

Ensure affordability and accessibility of renewable energy: to ensure that renewable energy is affordable and accessible to everyone, including low-income communities and developing countries.

Acceptance of the transition towards renewables: To ensure a successful transition to renewable energy sources, the project emphasises the importance of acceptance and buy-in from stakeholders, including government officials, businesses, and the public.

Involving nature as an actor: the importance of nature in the energy transition and advocates for involving nature as an actor in the transition process.

Mix of centralised and decentralised system: where energy is generated and distributed locally, reducing the reliance on centralised power grids and decreasing energy dependence. At the same time there are certain production areas that are well connected with the grid and can support local networks if needed.

HOW & WHEN TO GET THERE

Strategy

In this chapter the spatial interventions needed to achieve a just and resilient energy transition will be explained. The strategy focuses on two main hubs, the port of Rotterdam and Ruhr-area, and the rural spaces in-between.

The chapter starts off with the explanation of the goals of this strategy and the scales in which it is applied. The strategy is then divided in phases, shown in the x-curve and a timeline .

The spatial results of the strategy will be explained through various maps. First on the biggest scale of the port of Rotterdam, Ruhr-area and the in-between space. Then the focus is shifted into two rural areas in-between the two main hubs. Here the strategy is explained on smaller scales and more in detail.

To steer the development of the strategy and as a tool of participation of the stakeholders, a pattern language is created. This will be explained further.

Stakeholders are needed to establish the goals of the strategy, as this project envisions an active collaboration and participation of different stakeholders. Through analysis and the pattern language, the collisions and synergy of these stakeholders will be explained in both scales.

Goals

Focussing on Rotterdam and Ruhr-area as the main hubs, the goal is to create a strong backbone of connection between the two and the systems of in-between areas. Some areas will be left behind if they are not incorporated in the transition due to seeming lack of potential to keep up (socially, economically or spatially). However, this counteracts the goal of a just and resilient energy transition. After analysing the areas' potentials of energy production and spatial connection, the strategy aims to bring out these potentials, also in the rural areas at risk of being left behind, while equally spreading the benefits and the burdens that come along. To ensure this spatial justice,for example, new connections will be added to enforce the networks and increase accessibility.

To achieve a just and resilient energy transition, stakeholders involved need to be taken along the process. Therefore a pattern language is developed to steer the developments and used as a participatory tool for stakeholders. The patterns also give flexibility to the projects and give space for future uncertainties, which will be explained further.

Scales

The strategy works on different levels of governing and two scales: the scale M of the port of Rotterdam and Ruhr-area, and the scale XS of the in-between rural areas.

On the scale M, top-down initiatives will facilitate interventions that can happen on smaller scales while setting boundaries for energy production landscapes and nature.

The scale XS elaborates on bottom-up initiatives and the system of participation, though in Achterhoek top-down initiatives are also incorporated.

Further in the chapter, there will be zoom-ins on two different rural areas showing two different types of energy production system: a local, self-sustaining system and a system that also provides for the nearby cities. It is necessary to explore both the big scale and the smaller scales to explain how the systems work together and for each other.

On the scale M, the connection between Rotterdam and Ruhr-area will be enforced for both energy and knowledge exchange. This connection will cross the border between the Netherlands and Germany and will cover large distances. Therefore some in-between decentralised, 'rural' hubs will be needed to bridge the distance and manage the connection. Spatial analysis shows the area of **Nijmegen and Arnhem** as an important node in the network. Both energy infrastructures and rivers come together and form a knot in this area. These cities are close to the border and also function in a connection between north and south. Therefore the strategy on the bigger scale also involves the area of Nijmegen and Arnhem.

The first strategic zoom-in will happen in the **rural area near Rotterdam**. In this area, a self-sustaining form of rural energy production system will be explained along with the stakeholders that are involved. The border of the city of Rotterdam is also incorporated in the zoom-in to show the relationship with the city.

The second strategic zoom-in will happen **in Achterhoek, Gelderland**. This area shows a different type of rural energy production system and a different connection with the nearby cities. Here, instead of only self-sustaining , the rural area will also provide for the city, as cities do not have the space to be self-sufficient.

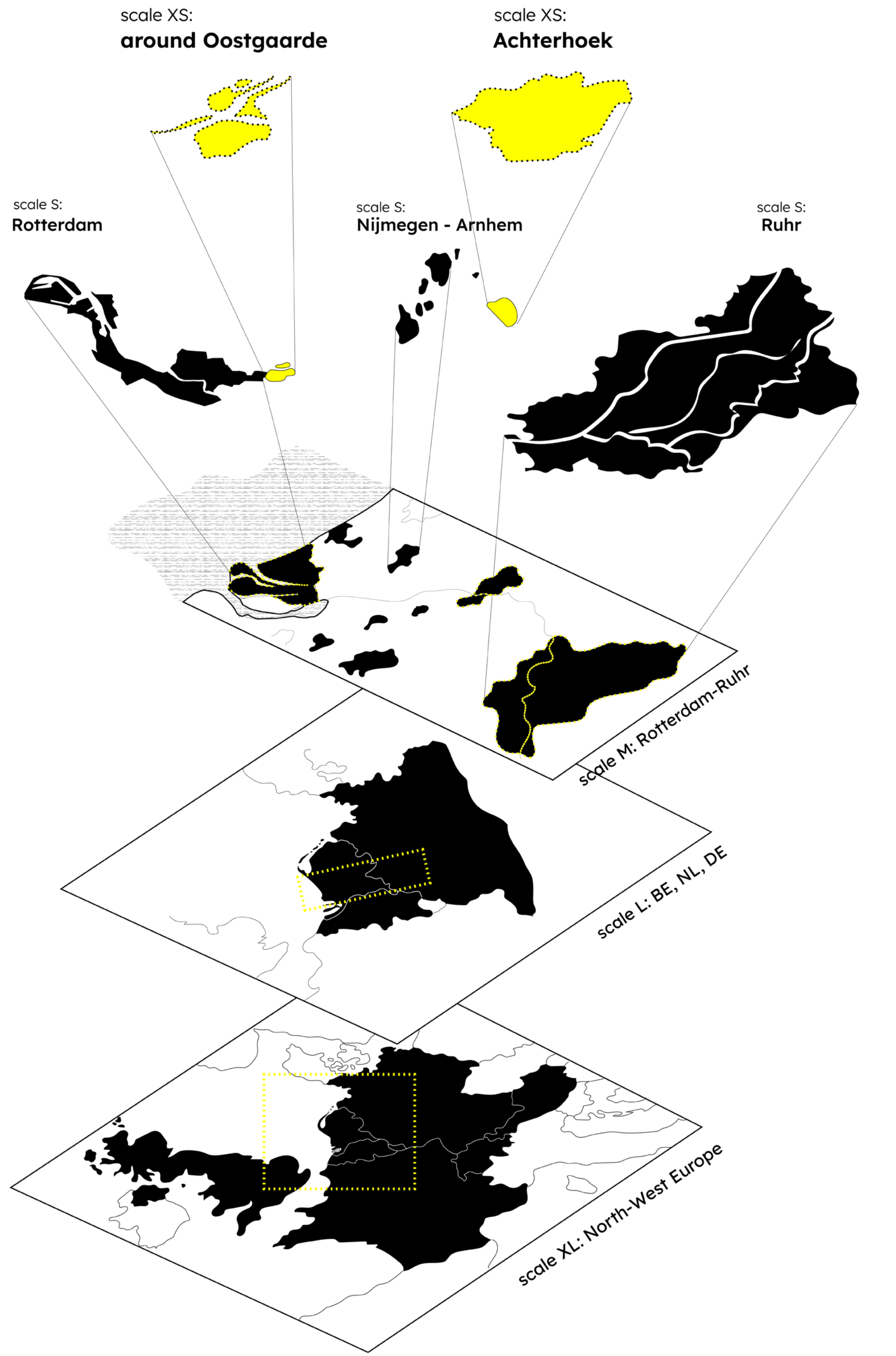


Figure 1

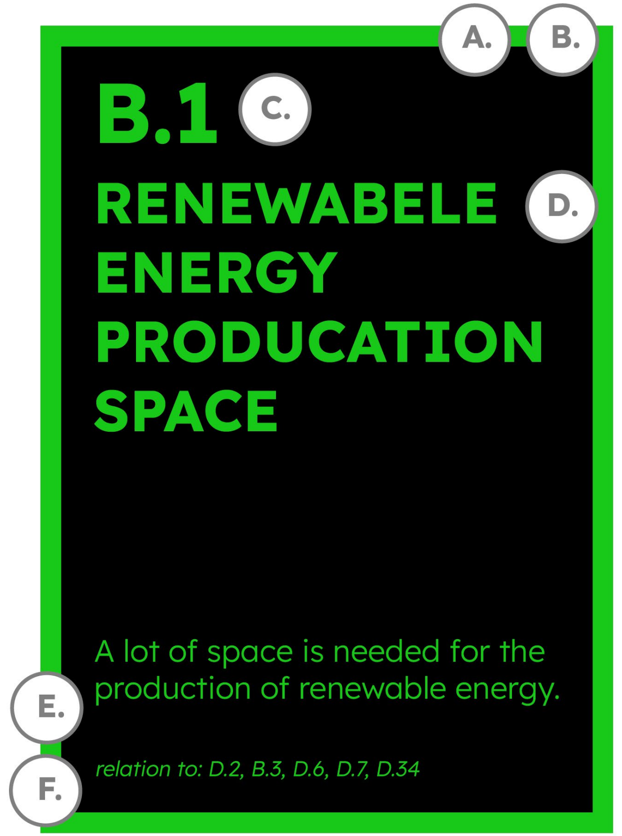
HOW & WHEN TO GET THERE

Pattern Laguage

The strategy of the project is expressed in a pattern language, a concept we introduced in the Theoretical framework (page 14-15). The pattern language has three functions in our strategy: it is a tool to structure our strategy, to facilitate participation in the final strategy and to support the process of designing and reflecting in creating the strategy. The pattern language structures our strategy by linking the strategy principles, spatial implications and policy recommendations throughout different scales. The different interrelations include prerequisites, implications and follow-ups, even bringing a time dimension to the pattern language. The pattern language also allowed us to detail the strategy and understand consequences of certain actions. As a first step towards the strategy, the spatial and policy implications were reviewed and categorised by each 'R' of the vision's R-ladder. These were placed on the X-curve and then turned into a pattern language, in categories according to the R-ladder and interrelations found on the X curve. Additionally, several zoom-ins were made in the strategy. Each one provided feedback on the pattern language, testing it for different scales and stakeholders. Following this method, patterns were added, connected, split, merged and removed, leading to the pattern language that is presented in this report. The pattern language also works as a participatory tool in the strategy. It is a way of sharing the complex information of a strategy in manageable form with participants in the decision and design process. (Chen, 2020). Some parts of the pattern language can be seen as step-by-step instructions where insights into alternatives can be gained, providing clear options and their pre-requisites or consequences (Finlay et al. 2002). In the participatory process, the design language can also be used as a "checklist", to confirm that all the necessary topics are covered, for example all the 'R's' in our pattern language (Finlay et al. 2002).

Patterns

The layout of patterns are explained in figure X. A pattern has a category, according to the R-ladder, a type (policy, strategy or spatial), a scale (international, national, regional or local), relations to other patterns, a title and a description. This layout is inspired by the project "Foundries of the Future: a Guide to 21st Century Cities of Making", which uses a pattern language to maker-cities of the future. (Hill, 2020). The relations in between the patterns were explored each time the pattern language was updated (see Appendix (pg X) for the matrix diagrams of interrelations of the patterns). This eventually led to the relations that are on the final patterns and the phasing of patterns on the X curve (pg. X).



A. **Category** of the pattern (indicated by color)
Refuse fossil fuels; Renew energy sources; Reduce energy demand; Repurpose & Rethink energy infrastructure and industry; Revitilise & Restore international trust; Revitilise & Restore ecology; Revitilise & Restore communities

B. **Type** of pattern
Strategic (no line), Policy (dashed line) or Spatial (line)

C. Identifying code (refers to **scale** and card number)
A = international; B = national; C = regional; D = local

D. **Title** of the pattern

E. **Description** of the pattern

F. **'relation to'** indicates links to other patterns
(for example pre-requisites, implications and follow-ups)

Policy recomendations

We have created patterns with policy recommendations to provide equality, a framework in which uncertainties can happen and impetus for action. We believe that it is necessary to support actions with necessary policies so the laws are not neglected or abused. We do not see them as a tool to control but a tool to respect the limits of fairness and allow creative responses to policies. Policy recommendations are linked with strategy and spatial patterns. On this page all those are presented with relations in between included. For further research and extension of patterns typology, additional policy needs to be developed in the future.

HOW & WHEN TO GET THERE

D.18 LOCAL HYDROGEN BUS CONNECTIONS
Improving accessibility of rural areas and renewable energy.
relation to: B.2, D.4, D.22, B.6 D.21, B.4, A.9

B.5 SUBSIDIES FOR RENEWABLES
Funding for renewables can come from the state, provinces, municipalities, European funds and NGO's
relation to: A.3, A.15, B.1, A.14, D.11, A.8, A.9, D.29, C.9, D.9, D.27, D.8, C.7, A.19, D.37

D.8 SUBSIDIES AND RENTING OUT ROOFS FOR SOLAR PRODUCTION
relation to: B.3, D.2, B.5, D.7

A.3 RESEARCH AND INNOVATIONS INTO RENEWABLES
relation to: A.4, A.5, A.15, A.16, A.21, D.37, C.2, B.5, A.6, B.8, C.9, B.1

R.3 REDUCE ENERGY DEMAND

B.7 REDUCE INDUSTRIAL ENERGY DEMAND
Policy: working with fines and rewards system. Use of energy when it's produced (ex.solar/tidal).
relation to: D.10, D.21, C.5

R.4 REPURPOSE & RETHINK ENERGY INFRASTRUCTURE AND INDUSTRIES

A.10 IN BETWEEN HUBS AND CROSS-BORDER STRENGTHENING OF NETWORK
neighborhood, local, regional scale storage; seasonal, batteries/h2 storage
relation to:A.13, A.8, C.4, A.11, A.19

B.8 DEVELOPMENT OF ENERGY NETWORK THAT SUPPORTS GROWTH AND CHANGE
keep optimising it to future energy system
relation to: A.3, A.16, A.19, A.6 D.7

C.5 CASCADING HEAT NETWORKS
With industry, living, commercial, offices etc.
in hubs, with residual heat, maybe also geothermal (depending on context)
relation to: A.13,D.17, D.11, D.21,

D.13 SHARED NEIGHBOURHOOD ELECTRICITY STORAGE SYSTEM
Electric cars can reduce the burden on the grid and increase reliability by decreasing energy transport needs.
relation to: A.9, D.7, D.28

D.16 RENEWABLE AND FOSSIL COMPANIES SHARE INDUSTRIAL SPACE IN HUBS.
create designated space for PPP/triple helix collaborations.
relation to: A.11, A.15

A.14 DEGLOBALISED PRODUCTION CYCLES
Of solar panels, wind turbines in current spaces of making and in industrial areas that are retrofitted. Focus on establishing European production chains, using materials from Europe when possible.
relation to: D.11, A.11, A.18, A.7, D.32

D.21 HUBS: HIGH ENERGY USE AND A LOT OF ENERGY IN THE SAME SPOT
Hubs offer access to hydrogen for high-density energy needs, reducing energy conversion and transport for a more efficient system.
relation to: A.11, D.10, D.4, B.7, C.5

D.19 ENERGY LANDSCAPES IN "WASTED" LANDSCAPES
for example space next to highways, old dump areas, drosscapes
relation to: B.1, D.11, D.25, D.6, B.3

D.6 REQUIREMENTS FOR ENERGY LANDSCAPES: CONTEXT AND POTENTIAL
relation to: D.2, B.12, C.6, D.11, D.34

D.9 LOANS WITH ZERO INTEREST TO BECOME AN ENERGY FARMER
relation to: D.20, B.5, D.7

A.4 BOOST AND FACILITATE CHANGES
Invest and research in new technologies and change in energy systems
relation to: A.3, B.5, A.5

A.7 HIGH STANDARDS FOR ENERGY EFFICIENT PRODUCTS
Policy: everything need to have A+++++ label.
relation to: A.19, A.18, A.14

C.4 LESS TRANSPORT & CONVERSION IN ENERGY NETWORK
reduce energy use
relation to: A.13, A.9, A.12

A.8 STRENGTHEN THE GRID
Put research to the test, and eventually scale it up. This needs
relation to: A.13, D.15, A.9, A.19

A.11 SPECIALISED ENERGY HUBS
Collaborating specialized hubs can convert fossil hubs into renewable ones with storage, distribution, conversion, and innovation, based on their context.
relation to: D.21, D.16, A.13, C.4, D.6

B.9 SEASONAL STORAGE OF ENERGY IN HYDROGEN
In hubs, big storage also to be shared across borders
relation to: A.9, D.21, C.4, A.13

D.11 FOSSIL INDUSTRY RETROFITTING
The project aims to revitalize nature, create mixed-use housing, and establish a center for renewable energy production and storage, as well as providing a space for learning, tourism, and local makers.
relation to: A.11, A.15, D.1, D.14, D.12, B.10, D.26, D.3

D.14 CONVERSION OF WIND ENERGY INTO HYDROGEN AT OLD OIL AND GAS PLATFORMS
relation to: D.11, C.3, D.4, B.10

D.17 LOCAL HEAT NETWORKS
with small scale sources like excess heat from sewage plants, surface water and seasonal storage of heat and cold.
relation to: A.13, D.10, D.4, C.5

A.15 PPP: COOPERATION STATE, FOSSIL AND RENEWABLE COMPANIES AND KNOWLEDGE INSTITUTES (TRIPLE HELIX)
Facilitating an inclusive energy transition through collaboration of knowledge, investment, and existing infrastructure, technology, and land.
relation to: A.19, D.16, D.11, A.13, D.27, B.1

D.20 ENERGY FARMERS
relation to: D.2, D.9, D.34, D.28, D.21, D.6, A.15, D.35

D.7 FRAMEWORK FOR PARTICIPATION IN ENERGY PRODCUTION
To support bottom-up process.
relation to: B.1, B.5, D.28, D.34, D.29, C.9

D.37 FUNDING OF INDEPENDENT RESEARCH
relation to: A.3, B.5, A.19

A.5 ANTICIPATE FUTURE THREATS
Research future scenarios and anticipate with plans, forecasting etc.
relation to: A.3, A.6, C.9, A.4

B.6 PROMOTE PUBLIC TRANSPORT
Reduce the energy use on transportation of people by promoting public transport over individual transport.
relation to: D.33, B.2, D.22

D.10 SMART ENERGY USE BY INDUSTRY & CONSUMERS
Industries focus on reusing energy/waste, waste management, using energy according to time flux. Residents are educated to reduce energy demand.
relation to: B.7, D.33, C.9, C.4,

A.9 DIFFERENT TYPES OF ENERGY STORAGE ON DIFFERENT SCALES
neighborhood, local, regional scale storage; seasonal, batteries/h2 storage
relation to: A.13, A.8, D.3, D.13, B.9, C.4

A.12 LESS AND RESTRICTED SEA TRAFFIC
Because of efficient international infrastructure, with the chance to expand natural areas more regional (NW EU) renewable energy production, less distribution of fossils.
relation to: C.4, C.6, A.13

B.10 RETROFITTING INDUSTRY NEXT TO RIVERS AND AT SEA
These are highly fossil focussed production areas and/or will have a less strategic position due to the rivers naturalising and therefore deserve special attention.
relation to: D.11, C.6, D.14

D.12 EXISTING BIOMASS PLANTS GET LOCAL SOURCES
Phase out using wood use GFT, and argicultural waste.
relation to: D.11, D.20, B.1

D.15 LOCAL TRANSFORMATION STATIONS REGULATING GRID CAPACITY
with extra storage, making sure the grid is not overcapacitated
relation to: A.9, D.21, D.36

A.13 MULTI-SCALAR NETWORK
different networks on different scales retrofitting existing fossil infrastructure.
relation to: C.4, D.17, C.5, A.8, A.9, A.10, D.31, D.6 , D.36, A.16

A.16 RETHINK THE ENERGY SYSTEM
Incorporate new technologies to review and improve the current system.
relation to: A.3, A.13, B.8, D.11, A.11

HOW & WHEN
TO GET THERE

R.5
REVITILISE & RESTORE ECOLOGY

B.12
PROTECT, CONNECT AND EXPAND NATURE AREAS

land scarcity puts pressure on natural zones

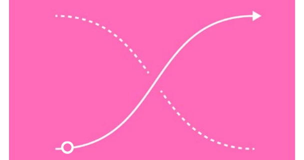
relation to:

R.6
REVITILISE & RESTORE INTERNATIOLAL TRUST

A.19
INTERNATIONAL ENERGY AND RESOURCE SHARING

relation to: A.18, A.17, A.20, A.21, B.5, A.10, A.14

R.7
REVITILISE & RESTORE COMMUNITIES



D.24
HISTORIC PLACES OF ENERGY EDUCATION

relation to: D.30

D.36
LOCAL TECHNICAL ORGANISATIONAL BODY

For managing, maintainance of energy structures.

relation to: A.13, D.31, D.7, D.28, , D.35, B.3, A.19

D.28
POLICY REGULATING ENERGY SHARING

relation to: D.34, D.31, D.36, D.20, D.13

D.31
CHEAPER LOCAL ENERGY

A designated radius around energy production site is considered local, and offers cheaper energy for residential use.

relation to: D.34, D.28, D.20

D.33
LIFESTYLE CHANGE

Live in energy landscapes, consume less energy, and reduce globalization.

relation to: C.9, D.29, B.6, B.11, D.32, D.10

C.6
NATURALISING WATERSCAPES, WITH FLOOD AND WATER STORAGE ZONES AND NATURAL BORDERS.

relation to: etrofitting on water & around rivers, mix use landscape of energy production

C.7
NATURE INCLUSIVE DEVELOPMENT

Enforcing rules and regulations to ensure retrofitted and new production and industrial sites are biodiverse and climate proof.

relation to:

A.17
TRANSPARENCY, HONESTY AGREEMENTS

relation to: A.19, A.20, A.18

A.20
NEW MANAGEMENT (BODY) OF ENERGY EUROPEAN UNION

New network, relationships, and governance guide initiatives and innovations.

relation to: A.19, A.17, A.18, A.3, B.8

D.22
BETTER LOCAL ACCESSIBILITY

Do not leave the areas behind, as just a passing-by.

relation to: B.6, D.18, D.5, D.34

D.25
EDUCATION: NORMALISING ENERGY IN THE LANDSCAPE

Promote renewable energy through artsy solar and wind installations along leisure routes, and support aquatic life with floating solar panels.

relation to: D.30, D.2, D.35

B.13
EDUCATION POLICY

Fund and institutionalize educational programs on various levels (schools, communities).

relation to: C.9

D.29
PARTICIPATORY PROCESSES

Local stakeholder groups can utilize pattern language and spatial insight tools to transition from NIMBY to ROHAC approach.

relation to: B.7, D.30, D.7, D.6, D.36,

C.9
EDUCATE AND INFORM

Educate and inform to increase acceptance, involvement, and awareness for development and lifestyle change, starting with refusal of fossil fuels.

relation to: B.13, D.30, D.7, D.29, D.35, B.5, D.10, D.27

D.34
LOCAL SHARING OF BENEFITS AND BURDENS OF ENERGY PRODUCTION LANDSCAPES

relation to: D.29, D.7, D.2, D.20, D.31, D.22, D.13, D.36, D.33, D.28

B.11
END OF ANTROPOCENTRIC VIEW

relation to:

A.18
POLICY FRAMEWORK FOR INTERNATIONAL COOPERATION

relation to: A.19, A.20, A.17

A.21
INTERNATIONAL KNOWLEDGE SHARING

One part of international collaboration is being smarter together. This is one of the ways that frontrunners can help .others

relation to: A.3, A.18, A.17, A.20

D.23
ENERGY EDUCATION IN PLACES OF CARE

Form alliances to invest and manage renewable energy together, while promoting energy demand reduction in local community centers and shared gardens.

relation to: D.30, D.29

D.26
MORE HOUSING

More jobs and population growth require more housing, which can be combined with energy production landscapes.

relation to: D.32, D.2, D.33, D.27

D.27
RETRAIN WORKERS OF FOSSIL FUEL INDUSTRY

Policy is implemented to retrain fossil fuel workers for jobs in renewable energy to ensure no one is left behind.

relation to: A.1, D.32, C.9, A.15, D.11

D.30
SPREADING INFORMATION AND LEARNING BASED ON REAL-LIFE CONNECTIONS

relation to: D.23, D.24, D.25, C.9, D.29

D.32
NEW JOBS IN RENEWABLE ENERGY PRODUCTIONS

relation to: D.26, B.1, D.27, D.11, A.14, D.36, A.20, C.9

D.35
BRANDING AND PROMOTION OF LOCALLY PRODUCED ENERGY

relation to: D.20, D.34, D.31, D.28, C.9, D.35

HOW & WHEN TO GET THERE

X curve & phasing

The patterns have several types of interrelations: pre-requisites, implications and follow-ups. These relations lead to the phasing of the project that is shown in figure 34. The phases are presented in the X-curve. How the change will include the phasing out of the fossil system, while the renewable energy system emerges and is accelerated, institutionalised and stabilised. The phasing diagram also presents several milestones, based on the European Unions and Dutch policies and the aimed consequences of the patterns. Eventually, in 2050, the goals of net zero, a 95% decrease of CO_2 emissions, the end of the anthropocentric view and lifestyle change will be achieved.

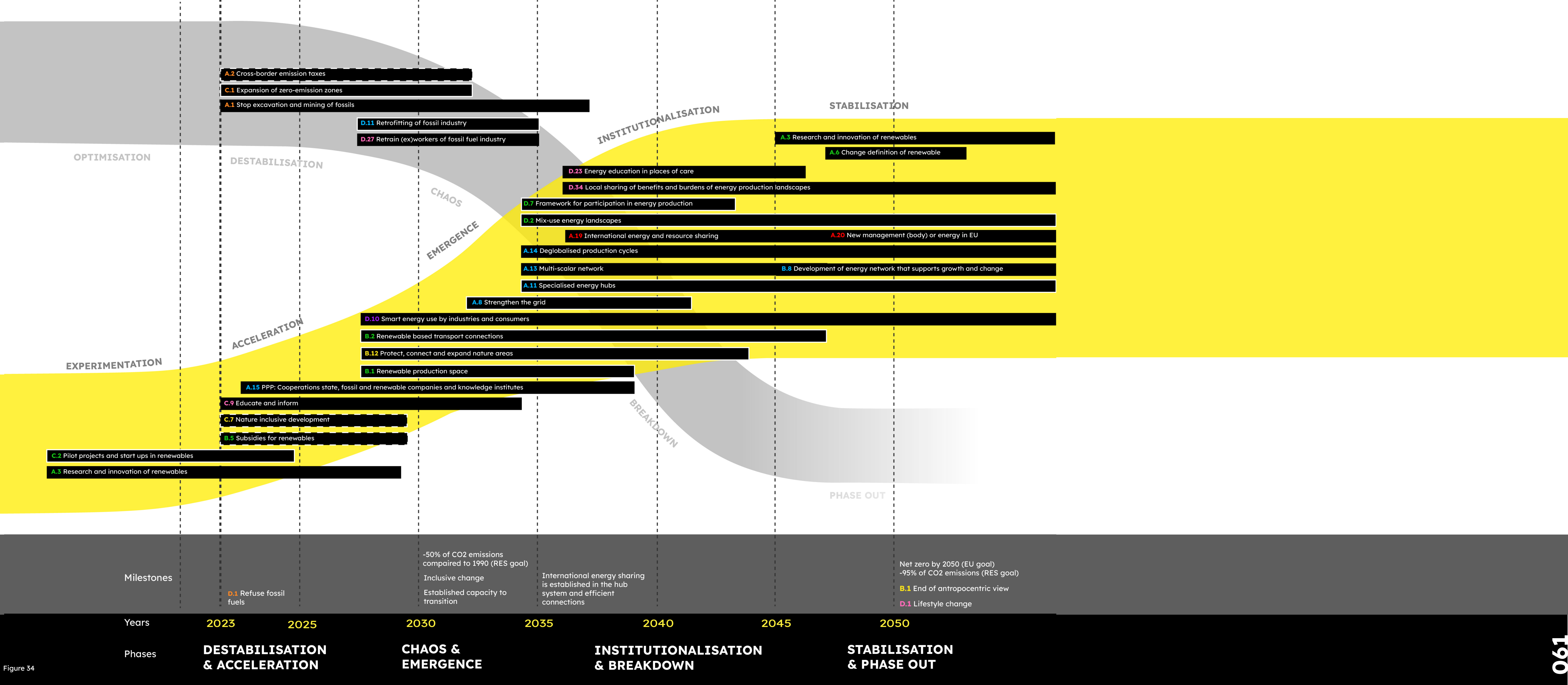


Figure 34

HOW & WHEN TO GET THERE

Stakeholders

The power-interest matrix (figure 35) presents the stakeholders of the project in the categories private (blue), public (yellow) and civil (green). A fourth category (red) includes the natural system and future generations (human and non-human). Future generations have a high interest in a renewable energy system, but no power to intervene. Simultaneously, the natural system has a lot of power, for example the changing weather and high impact natural disasters. It is an independent power that essentially does not care. It is represented this way in our project, because it will always have more power than humans. The specific roles and actions of the stakeholders will become apparent in combination with the patterns at the different scales in the next chapters.

Figure 35

Private stakeholders:

Private stakeholders include network companies (RRP, Gasunie, tuev Nord, TenneT and local grid owners (Stedin, Liander)), energy production companies (Fossil and, Electricity producers), energy suppliers, the European energy exchange, energy storage companies (Vopak, companies in hydrogen storage and batteries), start-ups in renewables, chemical industries, the Rotterdam Port Authority, banks and investment companies and farmers (big and small).

Most of these stakeholders have a lot of power, but little interest. Therefore, their attention needs to be shifted. For this, the project suggests the 'Triple Helix' approach: fossils, renewable stakeholders and knowledge institutions are brought together in a public-private participation. This is necessary as parts of the strategy include reusing fossil infrastructures (industry, network and storage) and retraining fossil workers.

The chemical industries have high energy consumption and are also using grey hydrogen (produced in an unsustainable way). Therefore their energy demand needs to decrease, which will be forced with policies and enlarging availability of renewable energy sources, for example green hydrogen in the port of Rotterdam.

Farmers own a lot of land and are therefore an important stakeholder. They need to be included as well as interested in the changes the landscape will undergo as energy production takes more space.

Banks and investment companies choose the most profitable investments and thus can fund energy transitions if they prove to be profitable. It needs to become apparent that renewables are the only long-term lucrative investment, so these companies will follow the profit.

Civil stakeholders:

Civil stakeholders include NGOs fighting for a sustainable, nature-inclusive future, research institutions, workers (and labour associations), citizens (consumers) and organised citizen groups (like NIMBY-groups). Research institutions are an essential part of change, as they boost and facilitate changes and anticipate future threats. Empowering and including consumers in the transition will shift their interest and make for an inclusive and thus more sustainable change. An interesting group to look at is Not In My BackYard, which should be rebranded as the ROHAC (Respect Our Habitat and Communities) group. When zooming into the Achterhoek area, the role and relevance of this group will become more apparent.

To gain insights for the power-interest diagram, a diagram is also created of the different kinds of stakeholders' power (production, blocking, diffuse power) and whether they are pro, against or fence-sitters in the project. This can be found in the Appendix.

Public stakeholders:

Public stakeholders include the Dutch and German government bodies and international bodies of governance (EU, UN). Within the Dutch government, the RES (Regional Energy Strategy) produces relevant policies and plans for our project. The municipalities will play a role in enabling participation of citizens at a smaller scale. The EU has the power to fast track international cooperation in renewable energy, an essential part of the strategy. In this, the EEX (European Energy Exchange) will also play a role.

HOW & WHEN TO GET THERE

Strategy scale M:
Rotterdam - Ruhr

Strategy on a scale of the corridor between Rotterdam and Ruhr has the main focus on creating cross-border energy system cooperation that is just and resilient. In the process of planning nature, infrastructure, transportation, land qualities and hub characteristics were taken into consideration. This example will present how pattern language can be used with top down stakeholders and strategic planning.

Infrastructure & transportation

Analyses of energy and gas infrastructure have revealed the importance of the Nijmegen-Arnhem hub. It is an important node between North and South as well as East and West, hence the area became important to the strategy. Electricity grid needs to be strengthened and better integrated to meet future demands. Missing links in the infrastructure were identified and planned for improvement. Most of them are located on the border between the Netherlands and Germany. This results in a more resilient regional network. Existing underground gas infrastructure is repurposed and reinforced to transport hydrogen. Main pipeline is created from the offshore windfarm to Rotterdam port, Nijmegen-Arnhem, Ruhr and further inland. On the way storage and hydrogen stations are created. Since the new energy production land is expanded to sea, those areas are specified and need to be developed in a nature inclusive way. Additionally specific waterways are planned to minimise impact of transportation and industry on sea waters.

Existing train line between Rotterdam South-East and Nijmegen-Arnhem is repurposed from freight line to passenger line as well. New stops on the way are created to connect areas with less or no public transportation. This will reduce emissions related to transport and take off pressure from river shipping.

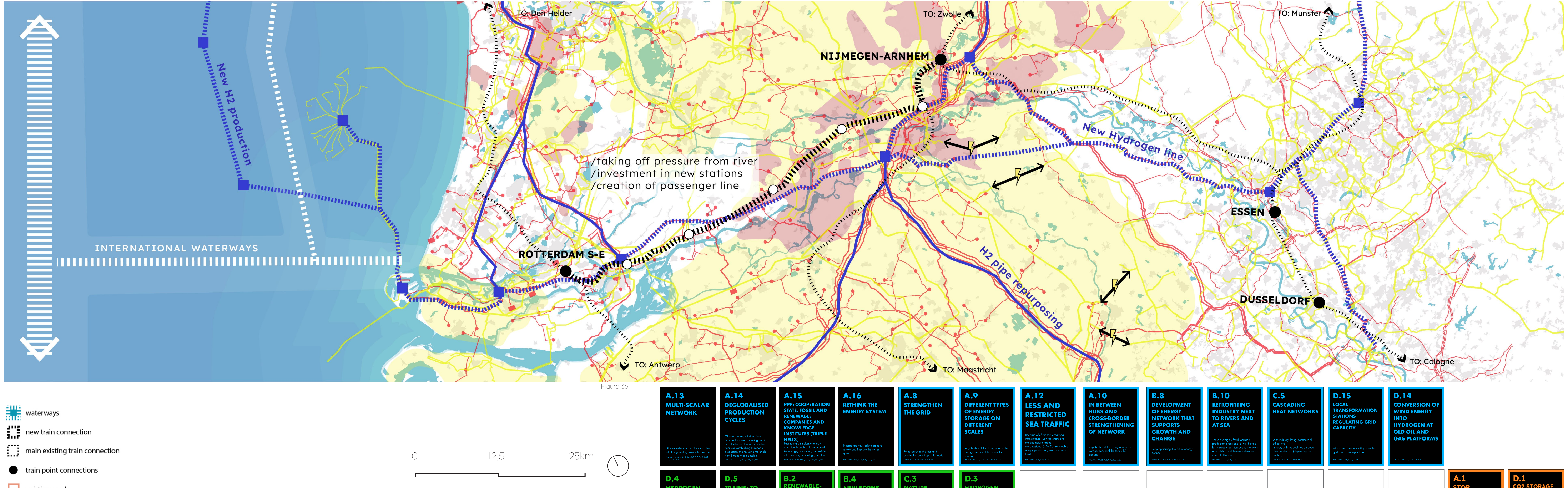


Figure 36

- waterways
- new train connection
- main existing train connection
- train point connections
- existing roads
- existing train line
- stronger h2 pipes
- new h2 pipe connection
- bad capacity of electricity grid
- worst capacity of electricity grid
- main distribution points
- electricity grid connections

A.13 MULTI-SCALAR NETWORK

A.14 DEGLOBALISED PRODUCTION CYCLES

A.15 PPP: COOPERATION STATE, FOSSIL AND RENEWABLE COMPANIES AND KNOWLEDGE INSTITUTES (TRIPLE HELIX)

A.16 RETHINK THE ENERGY SYSTEM

A.8 STRENGTHEN THE GRID

A.9 DIFFERENT TYPES OF ENERGY STORAGE ON DIFFERENT SCALES

A.12 LESS AND RESTRICTED SEA TRAFFIC

A.10 IN BETWEEN HUBS AND CROSS-BORDER STRENGTHENING OF NETWORK

B.8 DEVELOPMENT OF ENERGY NETWORK THAT SUPPORTS GROWTH AND CHANGE

B.10 RETROFITTING INDUSTRY NEXT TO RIVERS AND AT SEA

C.5 CASCADING HEAT NETWORKS

D.15 LOCAL TRANSFORMATION STATIONS REGULATING GRID CAPACITY

D.14 CONVERSION OF WIND ENERGY INTO HYDROGEN AT OLD OIL AND GAS PLATFORMS

D.4 HYDROGEN FOR BIG FORMS OF TRANSPORT

D.5 TRAINS: TO ELECTRIC, THEN TO HYDROGEN

B.2 RENEWABLE-BASED TRANSPORT CONNECTIONS

B.4 NEW FORMS OF TRANSPORT

C.3 NATURE INCLUSIVE WIND PARKS AT SEA

D.3 HYDROGEN STORAGE IN EMPTY GAS FIELDS (AT SEA)

A.1 STOP EXCAVATION AND PROCESSING OF FOSSIL FUELS

D.1 CO2 STORAGE IN EMPTY GAS FIELDS

B.6 PROMOTE PUBLIC TRANSPORT

C.4 LESS TRANSPORT & CONVERSION IN ENERGY NETWORK

D.32 NEW JOBS IN RENEWABLE ENERGY PRODUCTIONS

D.34 LOCAL SHARING OF BENEFITS AND BURDENS OF ENERGY PRODUCTION LANDSCAPES

D.27 RETRAIN WORKERS OF FOSSIL FUEL INDUSTRY

D.28 POLICY REGULATING ENERGY SHARING

D.31 CHEAPER LOCAL ENERGY

HOW & WHEN TO GET THERE

Strategy scale M:
Rotterdam - Ruhr

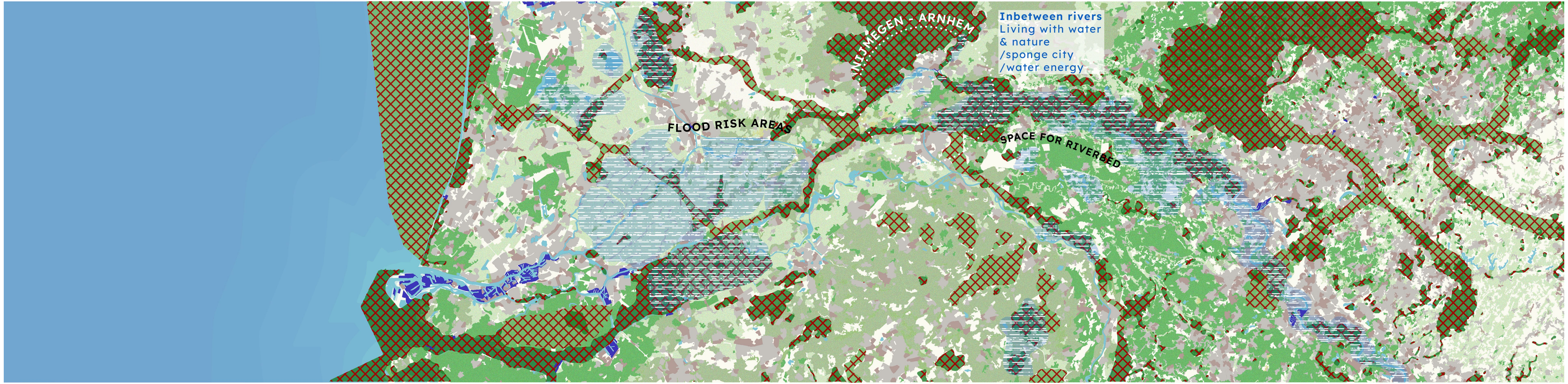


Figure 37

- waterways
- ports
- flood risk area
- existing protected natural area
- expanded protected natural area
- non-irrigated arable land
- vineyards
- fruit trees and berry plantations
- pastures
- complex cultivation patterns
- land principally occupied by agriculture

0 12,5 25km

A.2
CROSS-BORDER EMISSION TAXES
Stimulating refusing fossil fuels and genererating money to fund renewables.
relation to: A.1, C.1, A.18, A.17

C.1
EXPANSION OF ZERO-EMISSION ZONES
Pushing to phase out fossil transport and industry while
relation to: A.1, A.2, B.12, R.5

B.12
PROTECT, CONNECT AND EXPAND NATURE AREAS
land scarcity puts pressure on natural zones
relation to:

C.6
NATURALISING WATERSCAPES, WITH FLOOD AND WATER STORAGE ZONES AND NATURAL BORDERS.
relation to: etrofitting on water & around rivers, mix use landscape of energy production

C.7
NATURE INCLUSIVE DEVELOPMENT
Enforcing rules and regulations to ensure retrofitted and new production and industrial sites are biodiverse and climate proof.
relation to:

Protected nature & water bodies

Taking into account the fact that renewable energy sources take up much more space, natural protection areas have been expanded with possible creation of green corridors. In the future, the areas covered by the strategy plan are threatened by flooding. Floodplains and riverbeds have been increased, some areas have been identified for the possible development of sponge parks/towns. Hub Nijmegen-Arnhem is a place where rivers split and come together again, that is why this terrain was identified as a possible laboratory of living with water.

HOW & WHEN TO GET THERE

Strategy scale M:
Rotterdam - Ruhr

Land use

The site between Rotterdam and Ruhr-area was considered, in terms of existing production areas, the potential for renewable energy production and the character of the area. Every specified land will be multifunctional: energy production landscape and nature/recreation purpose, energy production landscape and city tissue, energy production landscape and agricultural area. Areas can embrace their potential and contribute to regional networks. In line with benefits and burdens sharing, cities have been included as a production site for e.g. solar panels. Near the Dutch coast offshore wind farms with hydrogen stations are created which gives the port of Rotterdam an important role. Nijmegen-Arnhem becomes a hub of cooperation between countries and a laboratory of innovations. The Ruhr area has to face the issue of retrofitting of industry and mine sites. Those places were identified and specified for transformation. Mines can become gravitational energy storage, tourist attractions, revitalised for nature areas. Industries can be repurposed to residential, service or natural recreation functions. Additionally Ruhr-area as a highly connected area can become a pleasant hub for living, education and technology innovations.

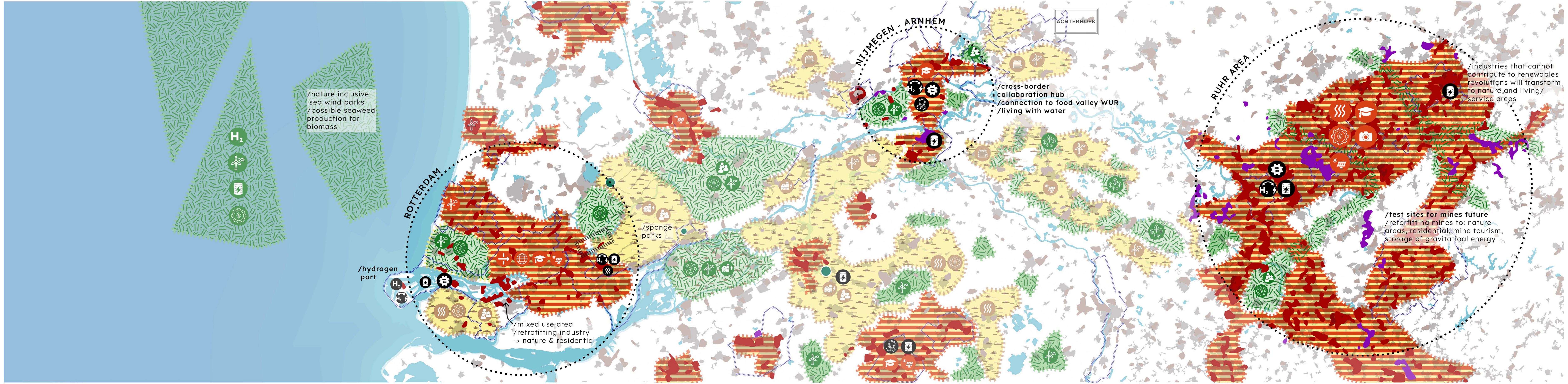


Figure 38

- production land & nature
- production land & residential
- production land & agriculture
- new biomass plants
- industry converted to storage/residantial
- retrofitted mines
- ports
- low income areas/social risk
- zoom in areas
- solar on rooftops
- heat network
- storage of energy
- conversion of energy
- point of trade/passing through
- managing role
- windpark
- hydrogen hub
- biomass energy
- high-tech specialization
- forest practice
- food hub
- nature inclusive development
- international importance
- energy tourism
- community involvment

0 12,5 25km

A.3 RESEARCH AND INNOVATIONS INTO RENEWABLES
relation to: A.4, A.5, A.15, A.16, A.21, D.6, C.2, B.5, A.6, B.8, C.9, B.1

A.4 BOOST AND FACILITATE CHANGES
Invest and research in new technologies and change in energy systems
relation to: A.3, B.5, A.5

A.5 ANTICIPATE FUTURE THREATS
Research future scenarios and anticipate with plans, forecasting etc.
relation to: A.3, A.6, C.9, A.4

A.6 CHANGE DEFINTION OF RENEWABLE
biomass phase out
excess heat phase out
from electricity to hydrogen as main energy source
relation to: A.3, B.8, B.11, A.16

B.1 RENEWABELE ENERGY PRODUCATION SPACE
A lot of space is needed for the production of renewable energy.
relation to: D.2, B.3, D.6, D.7, D.34

B.3 PRODUCTION IN RURAL AND CITY AREAS
Burden of production of energy not just on rural areas, also in city and industrial areas
relation to: D.8, D.6, D.2, D.7,

C.3 NATURE INCLUSIVE WIND PARKS AT SEA
with opportunities for seaweed production
relation to: D.2, C.6, D.3, D.14, B.12, D.6

D.2 MIX USE ENERGY LANDSCAPES
Multifuntional production landscapes like argiculture, residential, natural, industrial and recreational areas that produce energy. This is necessary because there is little space and renewables take a lot of space
relation to: B.1, B.12, C.6, C.3, D.9, D.19, D.20, B.3, D.6, D.26, D.11, D.33, D.25, D.26

D.6 REQUIREMENTS FOR ENERGY LANDSCAPES: CONTEXT AND POTENTIAL
relation to: D.2, B.12, C.6, D.11, D.34

D.8 SUBSIDIES AND RENTING OUT ROOFS FOR SOLAR PRODUCTION
relation to: B.3, D.2, B.5, D.7

D.20 ENERGY FARMERS
relation to: D.2, D.9, D.34, D.28, D.21, D.6, A.15, D.35

C.9 EDUCATE AND INFORM
Educate and inform to increase acceptance, involvement, and awareness for development and lifestyle change, starting with refusal of fossil fuels.

D.33 LIFESTYLE CHANGE
Live in energy landscapes, consume less energy, and reduce globalization.

D.34 LOCAL SHARING OF BENEFITS AND BURDENS OF ENERGY PRODUCTION LANDSCAPES

D.35 BRANDING AND PROMOTION OF LOCALLY PRODUCED ENERGY

B.13 EDUCATION POLICY
Fund and institutionalize educational programs on various levels (schools, communities).
relation to: C.9

D.24 HISTORIC PLACES OF ENERGY EDUCATION

D.25 EDUCATION: NORMALISING ENERGY IN THE LANDSCAPE
Promote renewable energy through artsy solar and wind installations along leisure routes, and support aquatic life with floating solar panels.

D.29 PARTICIPATORY PROCESSES
Local stakeholder groups can utilize pattern language and spatial insight tools to transition from NIMBY to ROHAC approach.

A.19 INTERNATIONAL ENERGY AND RESOURCE SHARING

A.20 NEW MANAGEMENT (BODY) OF ENERGY EUROPEAN UNION
New network, relationships, and governance guide initiatives and innovations.

A.21 INTERNATIONAL KNOWLEDGE SHARING
One part of international collaboration is being smarter together. This is one of the ways that frontrunners can help others

A.17 TRANSPARENCY, HONESTY AGREEMENTS

A.18 POLICY FRAMEWORK FOR INTERNATIONAL COOPERATION

D.21 HUBS: HIGH ENERGY USE AND A LOT OF ENERGY IN THE SAME SPOT
Hubs offer access to hydrogen for high-density energy needs, reducing energy conversion and transport for a more efficient system.

A.10 IN BETWEEN HUBS AND CROSS-BORDER STRENGTHENING OF NETWORK
neighborhood, local, regional scale storage; seasonal, batteries/h2 storage

A.11 SPECIALISED ENERGY HUBS
Collaborating specialized hubs can convert fossil hubs into renewable ones with storage, distribution, conversion, and innovation, based on their context.

D.11 FOSSIL INDUSTRY RETROFITTING
The project aims to revitalize nature, create mixed-use housing, and establish a center for renewable energy production and storage, as well as providing a space for learning, tourism, and local makers.

D.12 EXISTING BIOMASS PLANTS GET LOCAL SOURCES
Phase out using wood use GFT, and argicultural waste.

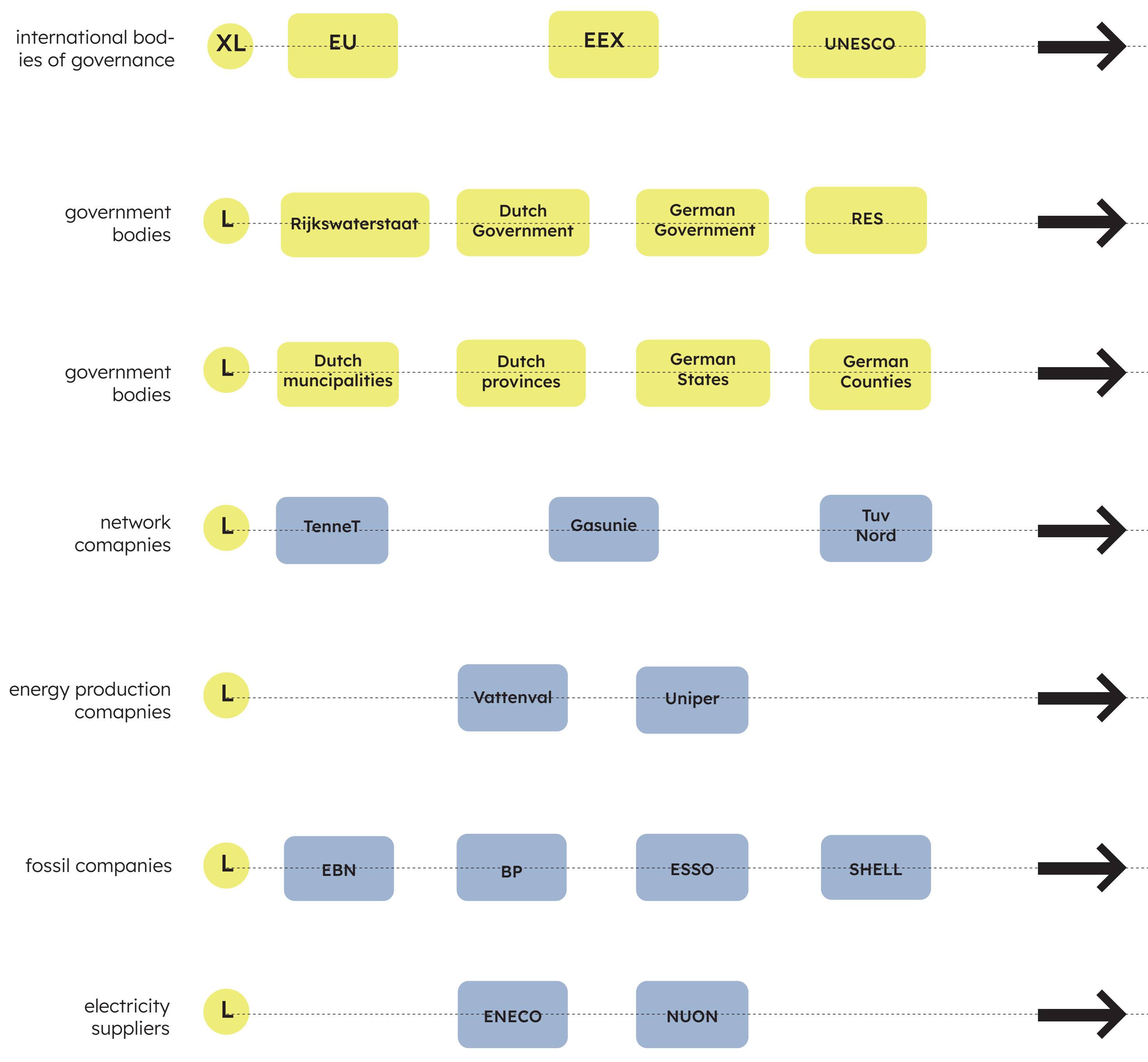
A.7 HIGH STANDARDS FOR ENERGY EFFICIENT PRODUCTS
Policy: everything need to have A+++++ label.

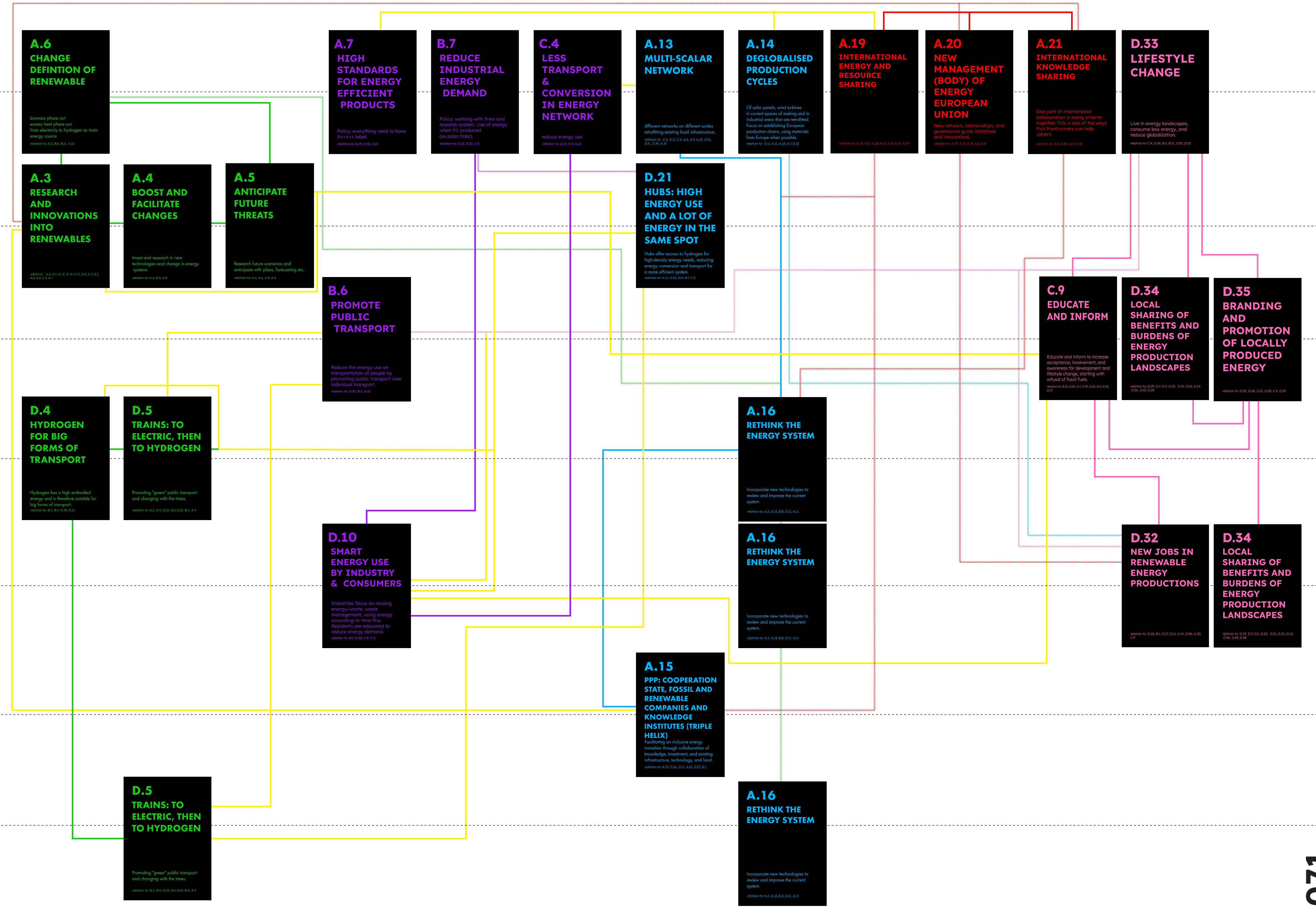
B.7 REDUCE INDUSTRIAL ENERGY DEMAND
Policy: working with fines and rewards system. Use of energy when it's produced (ex.solar/tidal).

D.10 SMART ENERGY USE BY INDUSTRY & CONSUMERS
Industries focus on reusing energy/waste, waste management, using energy according to time flux. Residents are educated to reduce energy demand.

HOW & WHEN TO GET THERE

Strategy scale M:
Rotterdam - Ruhr





Stakeholders

Pattern language, in this example, is presented as a simulation on regional scale. Main public and private stakeholders were included both from the Netherlands and Germany. Strategic patterns are used by top down stakeholders. Reactions of stakeholders with more power are included in the process and represented with related patterns. The pattern language approach allows stakeholders to better understand the complex interrelationships and feedback loops that exist between various factors in the regional context. By involving a wide range of stakeholders, the pattern language approach fosters collaboration and helps to build consensus around shared goals and objectives.

Rotterdam

On an international scale Rotterdam plays the role of a new hydrogen port with storage, conversion station and managing point. On the sea there are nature inclusive sea wind parks and possible seaweed production for biomass. City itself is a trade/pass through point, knowledge hub, production land of solar energy and near the sea there are onshore wind farms. Industry in the south is retrofitted to nature inclusive or residential areas. Areas further from that are producing geothermal energy and are nature inclusive. Strong community participation and social acceptance is needed there. East part of the area has biomass production potential, recreational routes, nature inclusive development and sponge parks.


Figure 39

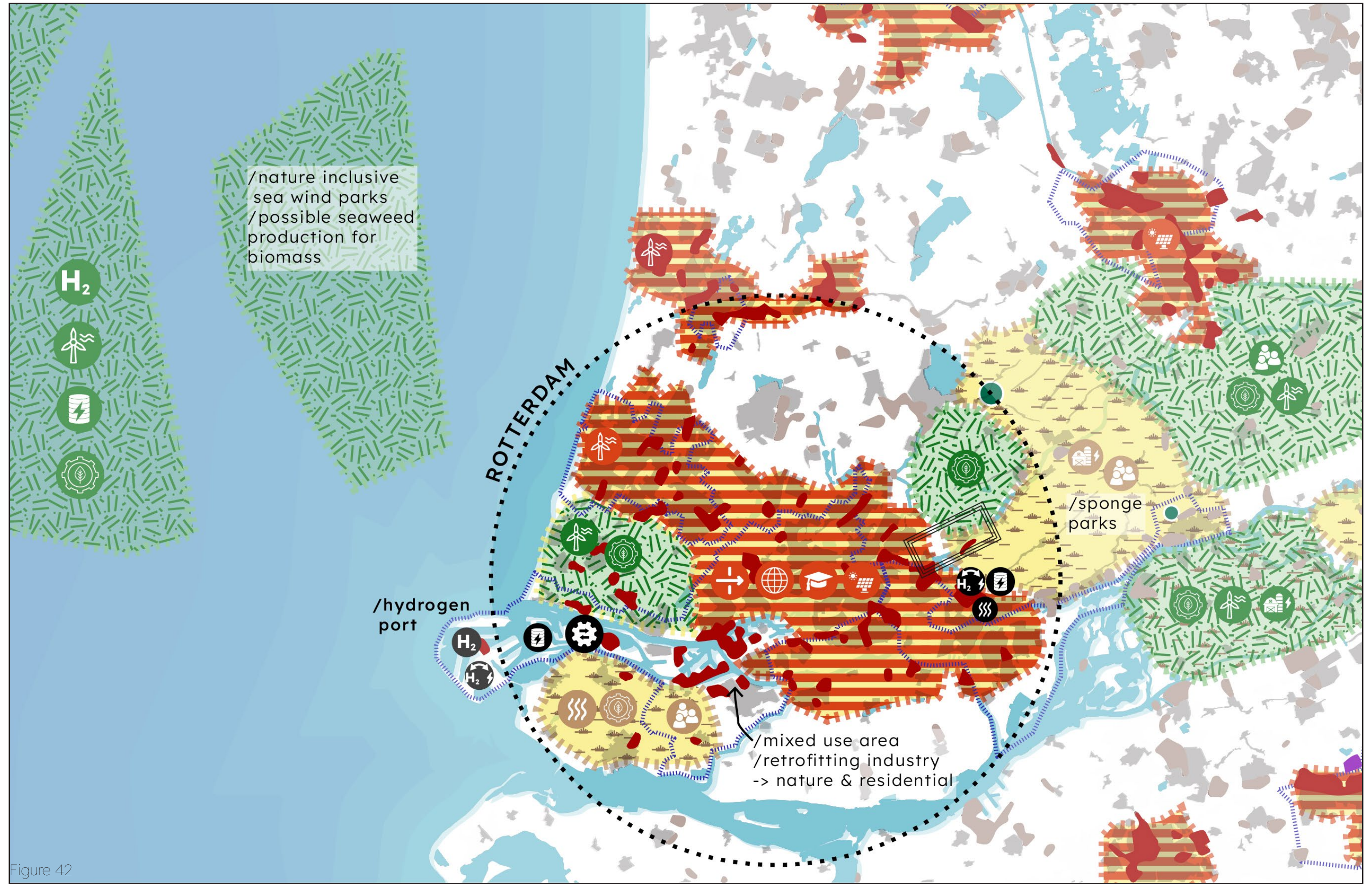


Figure 42

Nijmegen - Arnhem

This area has an international importance as a cross border collaboration hub, managing role, is an innovation and knowledge laboratory. Storage of hydrogen and a conversion station is planned there. Around the area are nature inclusive spaces, windmills, agriculture and food production land (possible connection to food valley WUR). Nijmegen-Arnhem is a place where rivers are splitting that gives an opportunity for a laboratory of living with water development.


Figure 40

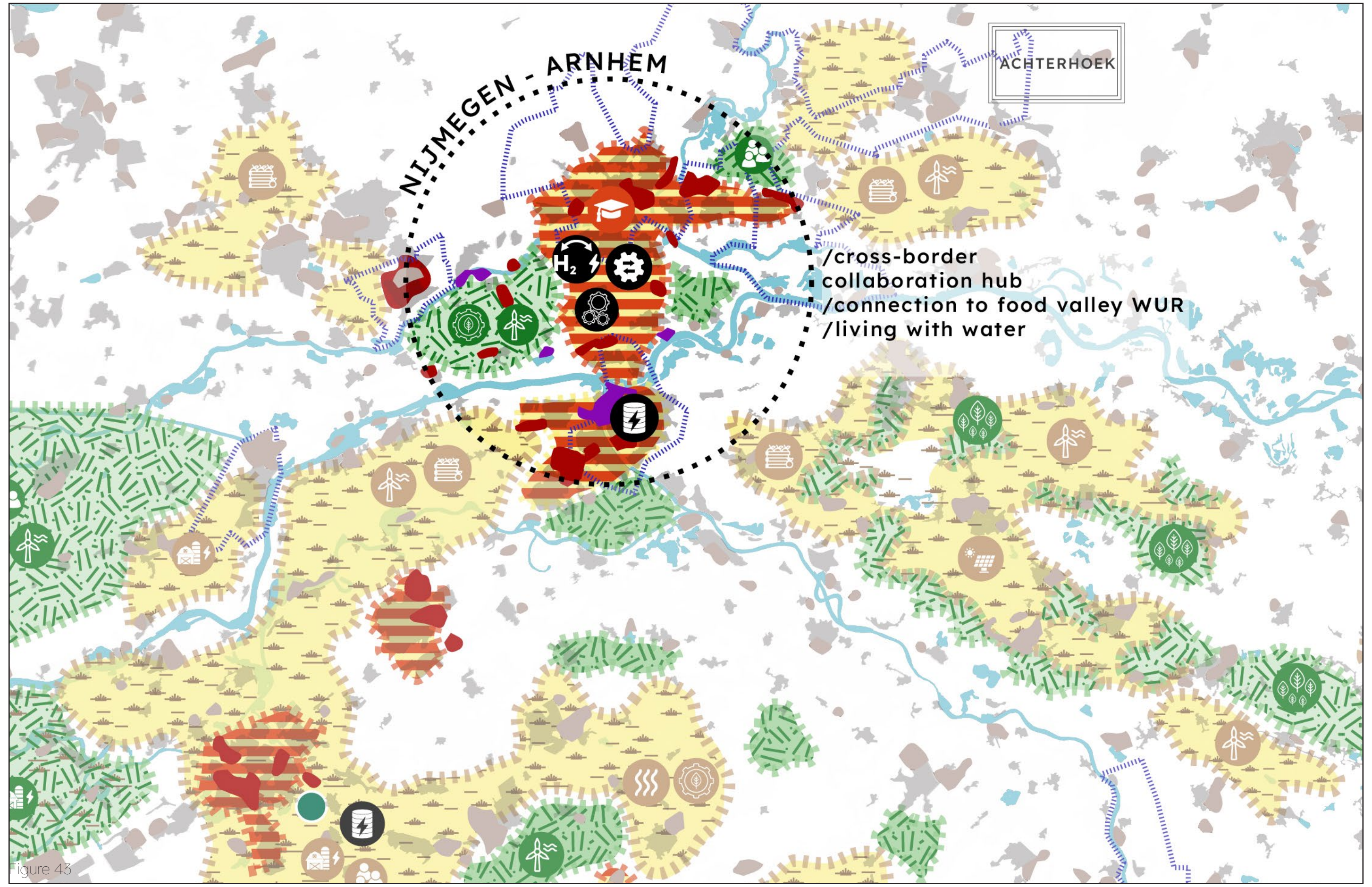


Figure 43

Ruhr

Ruhr agglomeration is a knowledge hub, point of post industrial tourism surrounded by agro forestry lands. City has a potential for solar and geothermal energy production. Internationally Ruhr plays a managing role, has hydrogen storage, conversion station and infrastructure that connect inland areas. Those great connections allow it to become a distribution point and pleasant place to live. The site is in need of retrofitting industry and mines to nature areas, mine tourism or storage of gravitational energy.


Figure 41

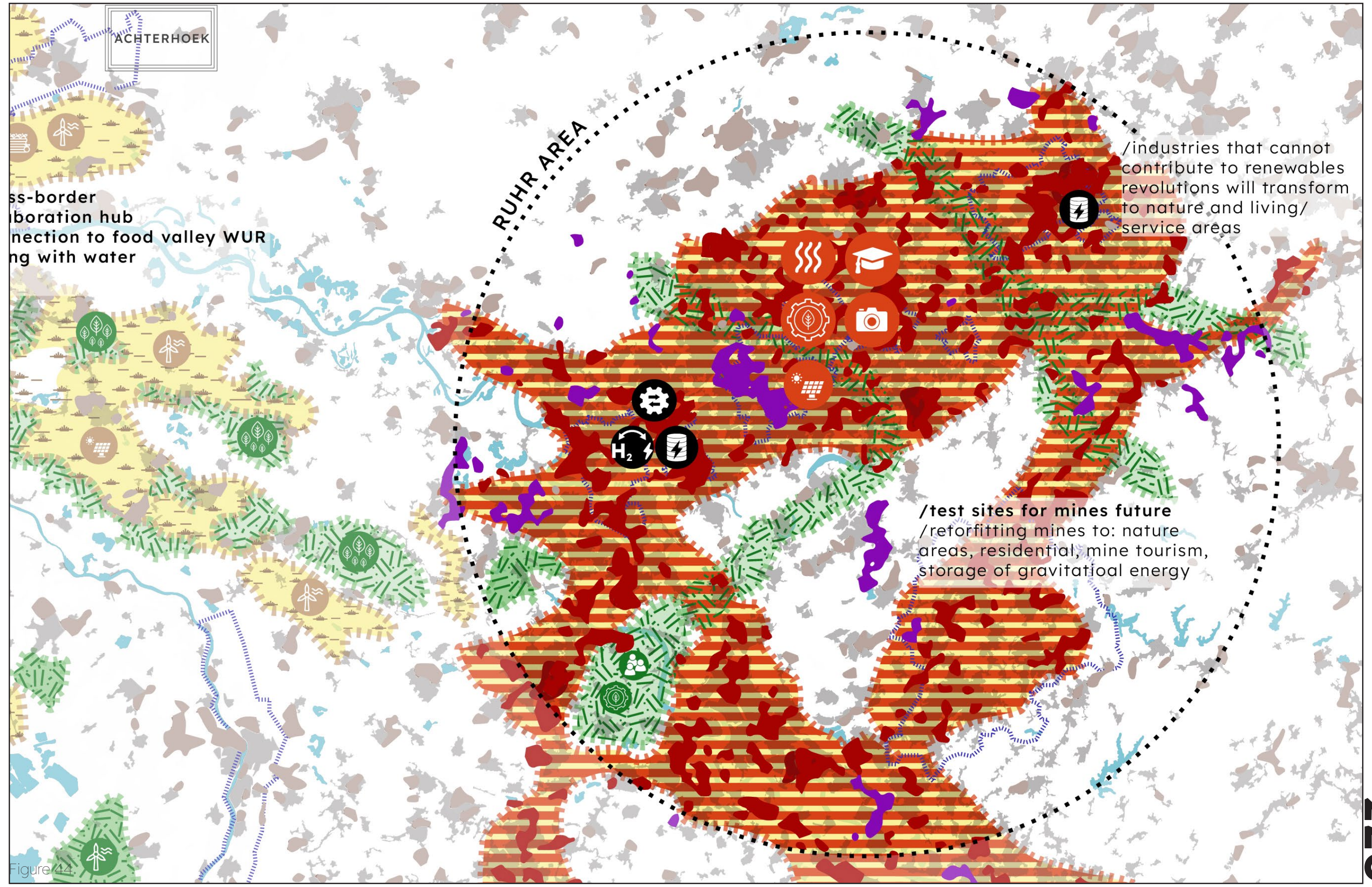


Figure 44

HOW & WHEN TO GET THERE

Strategy scale XS:
Achterhoek

Energy production in the Achterhoek

Achterhoek is a rural, in-between area, where in the future development of renewable energy production might cover more space Not just to produce energy for the local residents, but also for nearby cities and hubs, like Arhnem-Nijmegen. This is in line with the regional energy strategy of Achterhoek, which proposes to produce 1,35 TWh in the area, in 2030 (RES 1.0 Achterhoek - RES Achterhoek, n.d.). However, if the Achterhoek would provide energy for the nearby cities of Arnhem and Nijmegen, a production of 13,5TWh would be necessary in 2030 (Regioan (2021).

Inclusive changes: NIMBY to ROHAC and other stakeholders

Decisions about this necessary energy production should include the people who live and work in the area, while balancing top-down planning and bottom-up participation. This also applies to other big changes in the area, like the improvement of the accessibility of Achterhoek by public transport. Gelderland, the province in which Achterhoek is located, is also a place in-between hubs, which is why strong connections are important. For this, the electricity grid needs to be strengthened for example, as it already can not keep up with the demand (Liander, n.d.). On a bigger scale, Achterhoek and Gelderland are part of connections between Rotterdam and Ruhr (officially part of the Rhine-Alpine corridor). To strengthen this connection, a "Noordtak" (Northern branch) of the Betuwelijn (Rotterdam to Ruhr connection for goods) has been proposed many times. This is an example where residents were not included in the process, the government tried to force these plans top-down, but the residents came in action and organised themselves in a "Stop the Noordtak" group.

Groups like this are often called "NIMBY'ers", Not In My Backyarders. This terminology suggests that these people are an opponent of change, with a short-sighted, egocentric motive: to just not have a certain change on their own plot of land or very close to it (Team Stadszaken, 2022). But very often, this is untrue. Firstly, it is an understandable defensive reflex to the feeling of being overwhelmed by plans of the government and market. The fact that people are raising their voice and wanting to participate should be welcomed. Furthermore, these protest groups often have a collective character, wanting the best for their (future) local community. These groups research and analyse the situations and come with alternatives that for example fit the local context better. Therefore NIMBY-groups, or actually ROHAC (Respect our Habitat and Communities) groups, should be seen as participating, rich sources of knowledge and experience (Team Stadszaken, 2022). In the example of Stop the Noordtak, the residents were for example looking out for the charactacter of the Achterhoek, of peace, meadows, forests and spaciousness, they challenged and included political parties, researched the current capacity of the Betuwelijn and made very accurate statements about the lack of benefits for local residents.

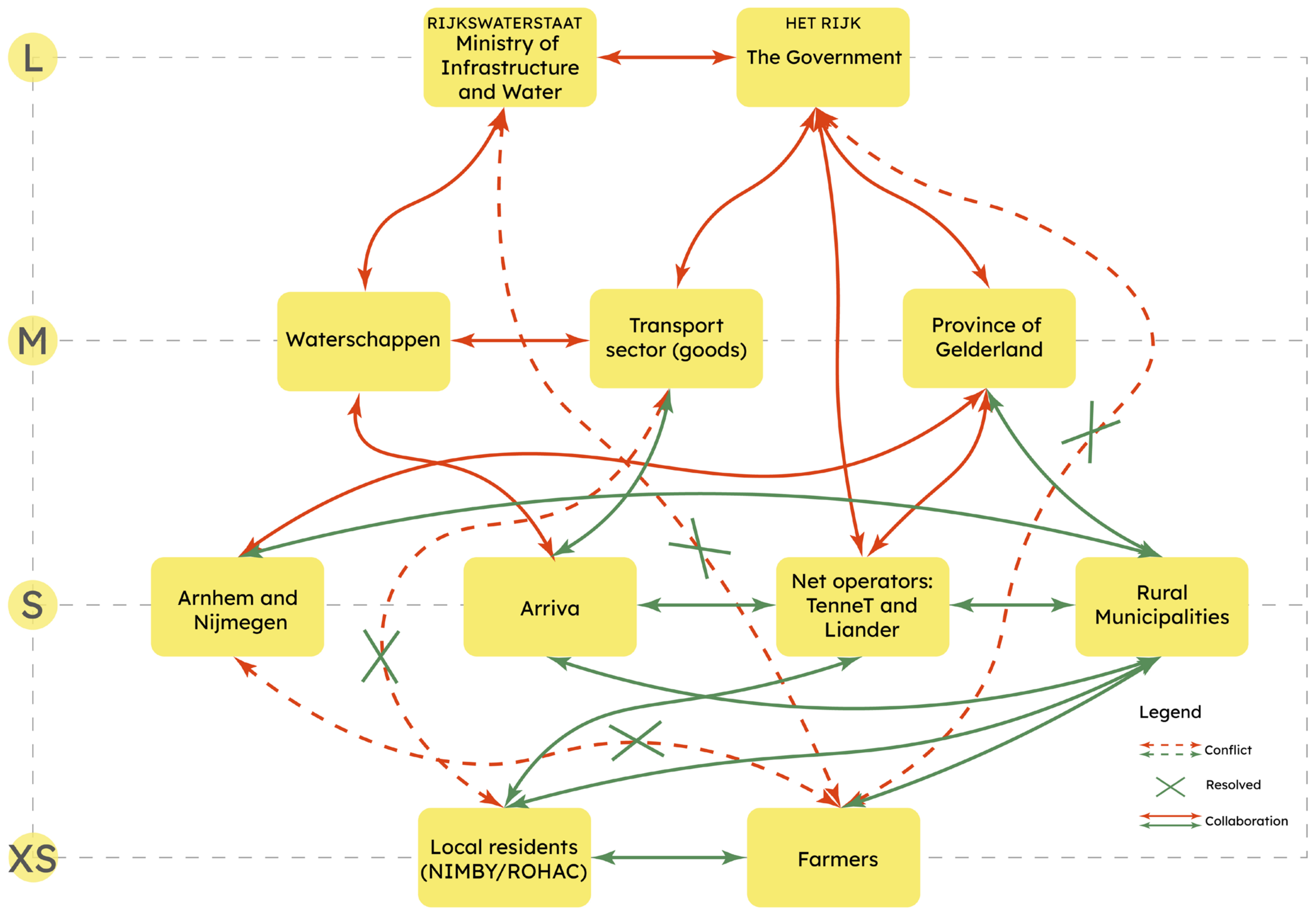


Figure 45

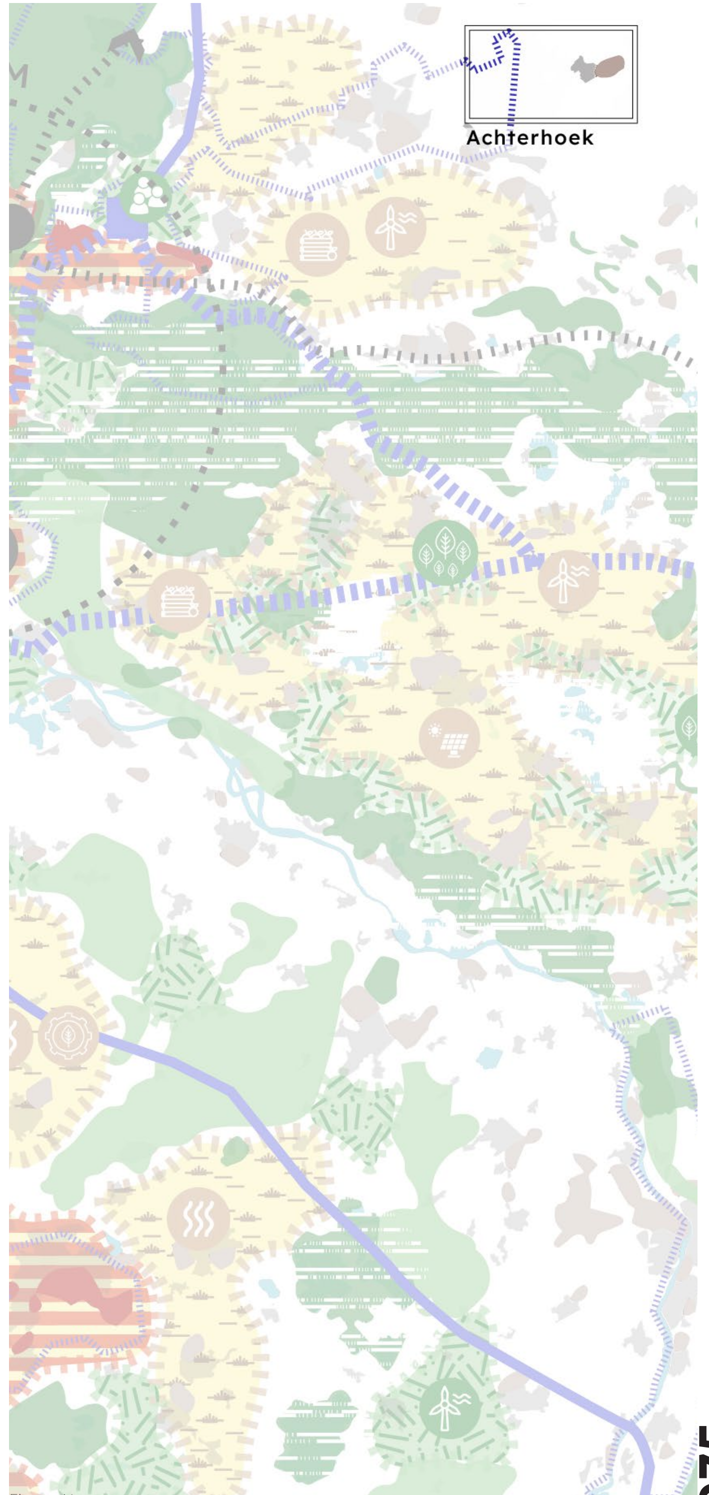


Figure 46

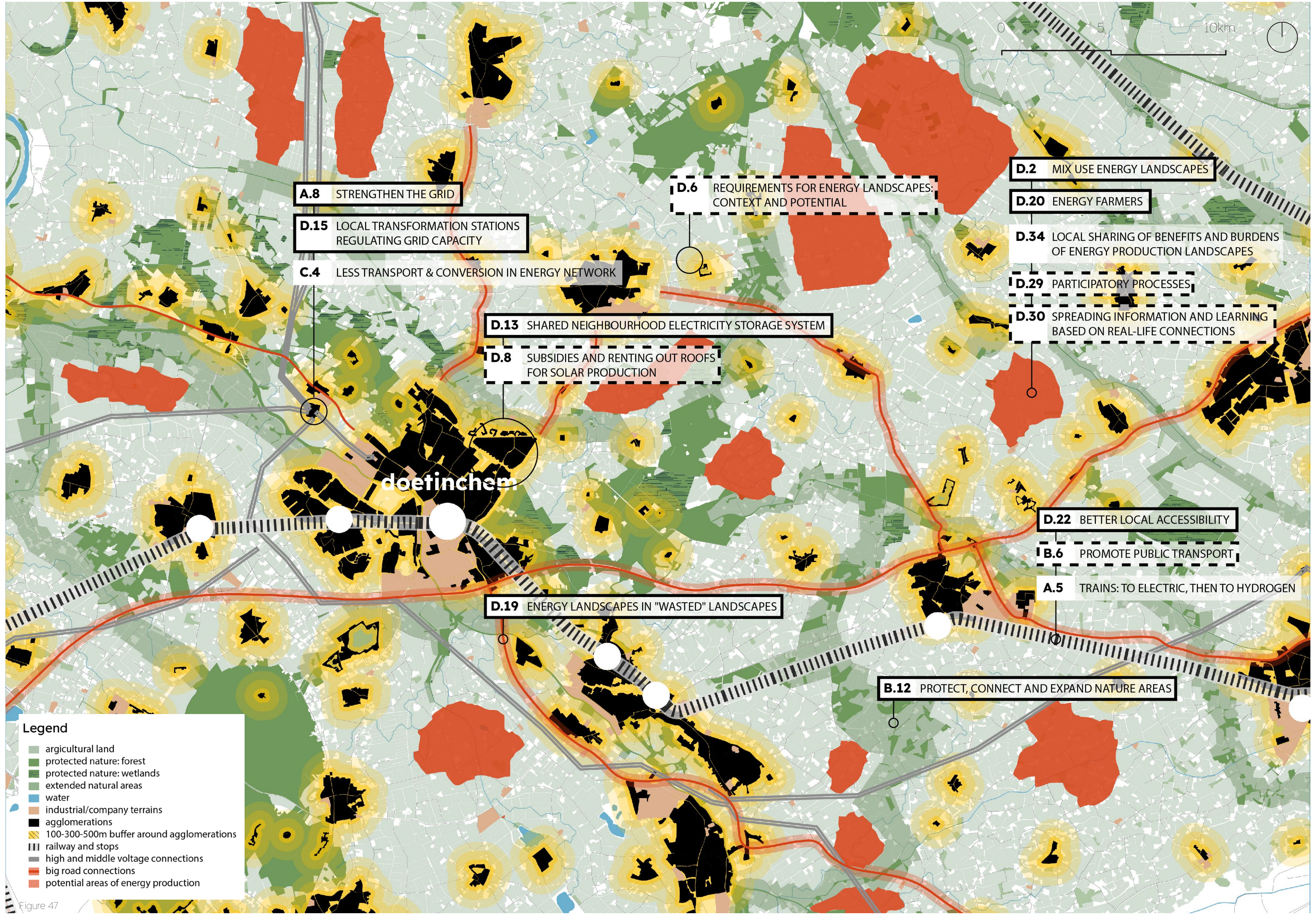


Figure 47

Process of co-creation

In the process of co-creation, residents can plan the energy production in Achterhoek. The playing field consists of a map with proposed big, top-down changes like electrifying the train network, improving the grid capacity and connecting nature areas. The map also has potential spaces for energy production, for example on agricultural land, on roofs, in commercial areas, around major roads, and set boundaries not close to nature or within 300-500 metres of a settlement. The pattern language is used as a participatory tool, giving insight into the different scales and pre-requisites or consequences of changes. For example if one wants to put a subsidy in place for everyone to be able to put solar panels on the roofs, we also need to think about the storage of energy and strengthening the grid. Additionally, insight in the spatial coverage of energy production is provided, showing the difference in wind, solar and biomass. Lastly, photos of mix-use landscapes boost participants to creative thinking about future landscapes.

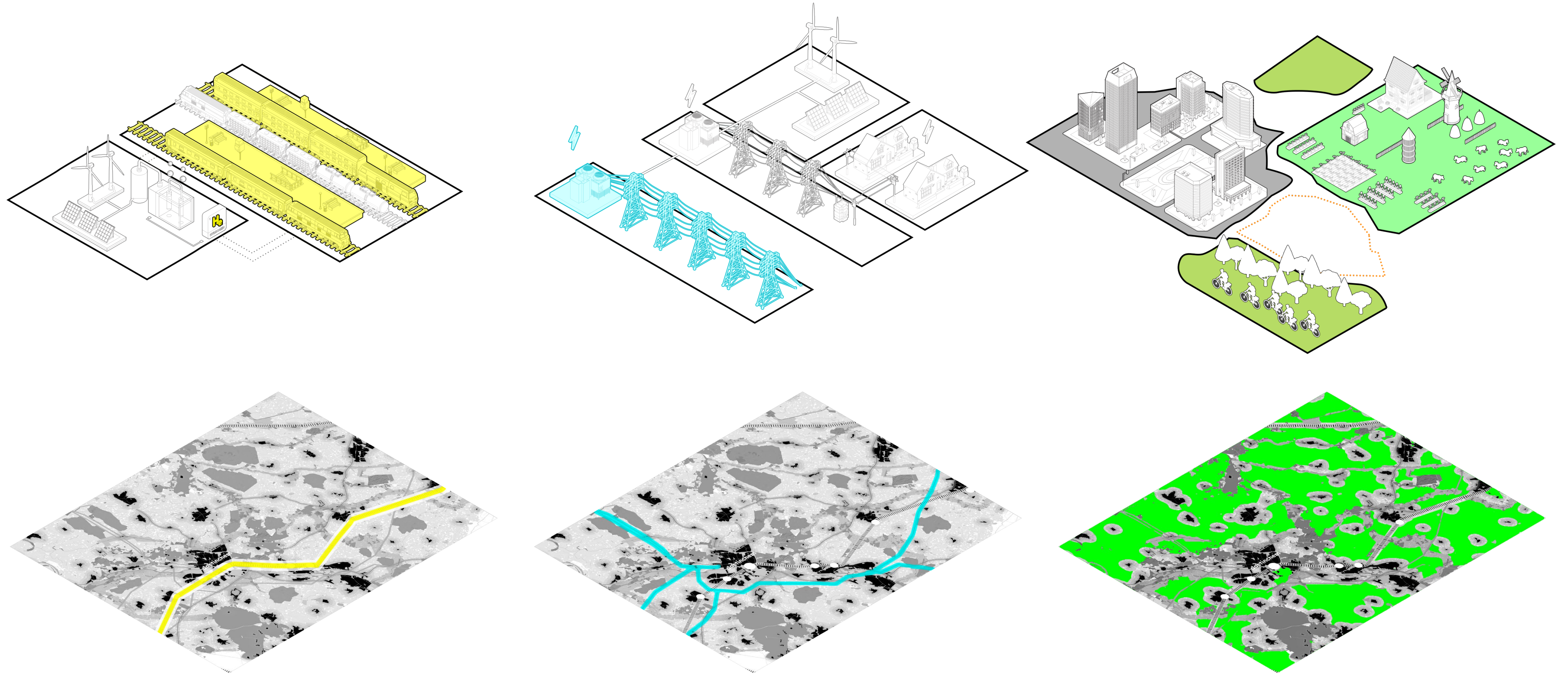


Figure 48

HOW & WHEN TO GET THERE

Strategy scale XS:
Achterhoek

Figure 49

3 outcomes of simulation

The first scenario depicts a power shift where the NYMBY \ROHAC become the primary decision-makers. Under this scenario, a pattern of ecological preservation, mixed energy landscapes, people's participation, and top-down collaboration would be observed. To generate sufficient energy, windmills would be placed in areas where they do not harm the natural environment, the city, or people's living standards, in terms of visual and noise disturbance.

In the second scenario, the government holds full power and attempts to maximise energy production without adequately considering the other stakeholders. In this scenario, every possible area is utilised for energy production, with or without compensation for the farmers for the use of their agricultural land.

The third scenario highlights the case where farmers become the primary decision-makers, limiting the use of agricultural land to an agreed percentage. To compensate for the energy deficit, solar-powered energy would be generated through maximum utilisation of rooftops, leading to a bottom-up energy generation process. However, this scenario faces space limitations for energy storage and reliance on fossil fuels.

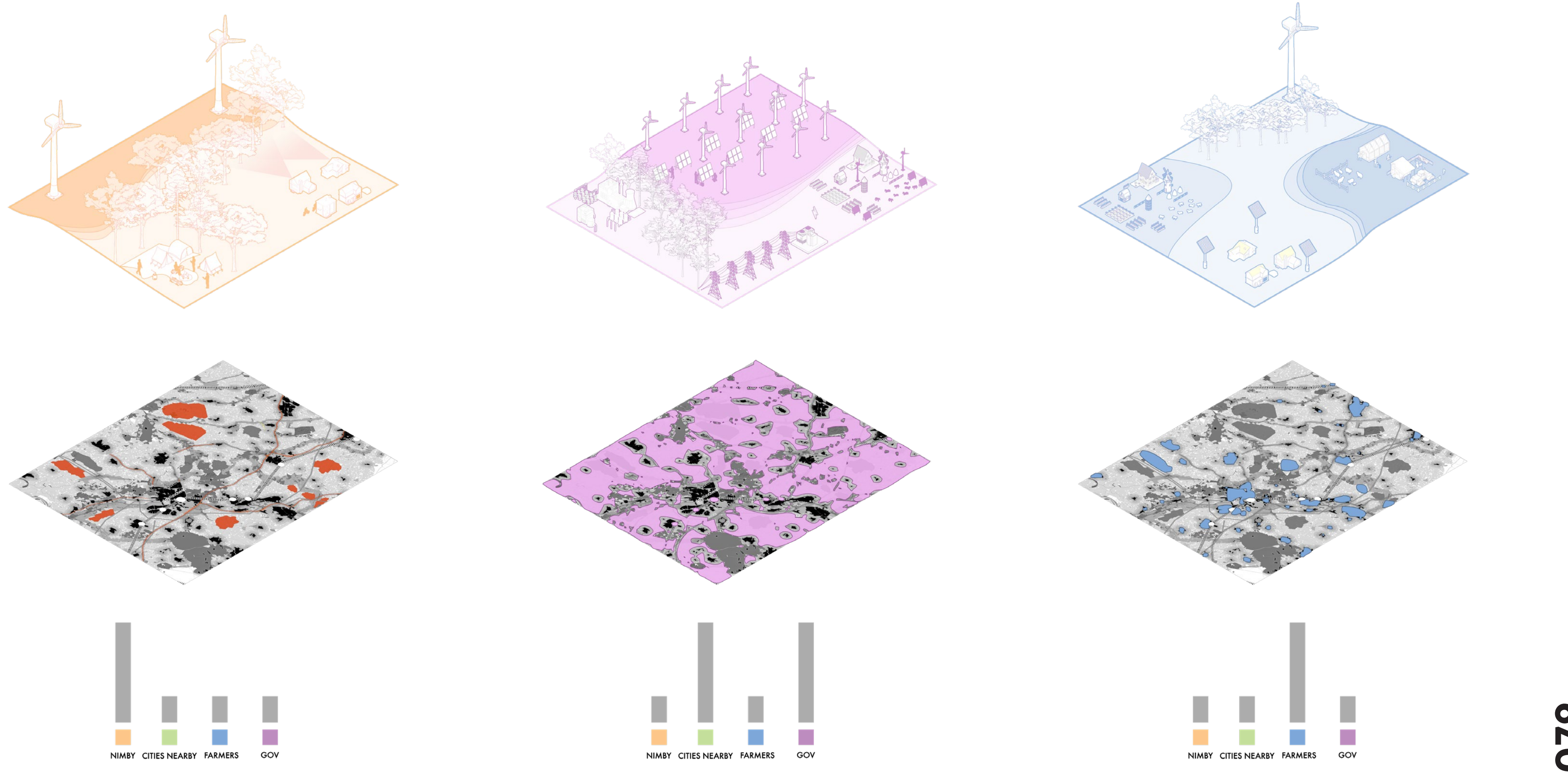


Figure 50

HOW & WHEN TO GET THERE

Strategy scale XS:
Between Rotterdam & Green heart

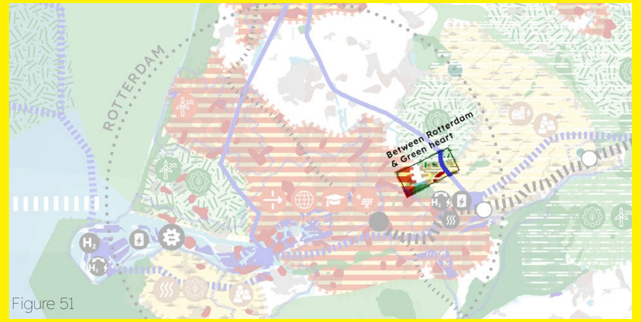


Figure 51

This area of zoom-in includes the edge of Rotterdam city and the municipalities of Molenlanden and Krimpenerwaard. A local and self-sustaining energy system is introduced here in the rural area and the direct relation with the edge of the city is shown. An example of this system already exists in Flanders, Belgium (Friends of the Earth Europe, 2020) where a co-housing initiative evolved into an energy cooperative. This example shows that acceptance is achievable for renewable energy and residents are willing to invest in it.

The rural area consists of the towns (Krimpen aan den IJssel, Krimpen aan de Lek, Ridderkerk, Lekkerkerk, Nieuw-Lekkerland, Kinderdijk) and the agricultural land in-between. Herein, enough energy will be produced to cover their usage. Areas of energy production will be bound by rivers and protected nature as it is needed to use the most of the land's potential. The energy system will be further divided into: local production, individual production and community storage. Here, the main stakeholders, residents and local farmers, can co-create their area using the pattern language. The goal for this area is to have a self-sustaining energy system that is resilient due to the independent and strengthened community.

Local Production
Local farmers (dairy) have the space to produce large amounts of energy that not only cover their own use but also parts of the usage of nearby towns. Their land has potential for wind, solar and biomass energy and the farmers can decide individually their methods of production. Residents of nearby towns can then buy the energy from the farmers instead of getting it from the main grid. To motivate this system of local production, policy will be needed to facilitate the transition for farmers to profit from the dairy industry to energy production. For example, farmers can apply for subsidies or zero-interest loans for the resources to start producing energy; they can also get some compensation at the beginning for stepping away from or reducing dairy production; energy coaches can help farmers set up their farms and advice them in further development; a local control party should be introduced that can be responsible for technical aspects like energy infrastructure.

Individual Production
Instead of consuming energy from the main grid, residents of nearby towns can eventually detach from it and be fully dependent on locally produced energy. Apart from the energy they buy from local farmers, residents can also organise initiatives to generate energy within their neighbourhood. For example, some residents can rent out parts of their roof or garden for other residents who do not have enough space to set up solar panels there. Or, residents can decide to invest in one big windmill near their neighbourhood together. Residents can come together in community centres in their town to organise and vote for initiatives. Here, support from institutions can be provided personally and become more reachable for residents. In addition, education is needed to ensure residents are informed about the possibilities, pro's and con's of renewable energy production. This can be provided also within community centres and through energy coaches with a more personal approach.

Community Storage
Nearby towns can store their energy in a local storage. Residents are connected to these storages via a local grid. With this, a small area will have more energy security as they have control over their own energy in- and outflows. Eventually, the energy system might be fully independent from the main energy grid. This depends on the intentions of the local residents and the technology that is available in the future.

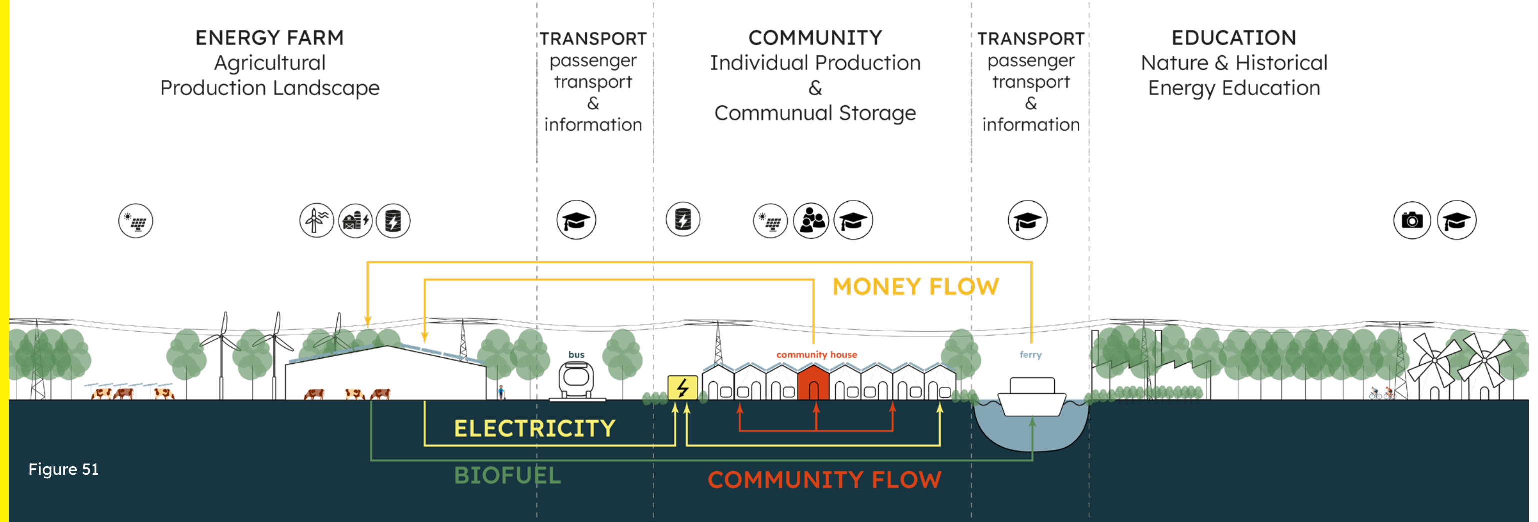


Figure 51

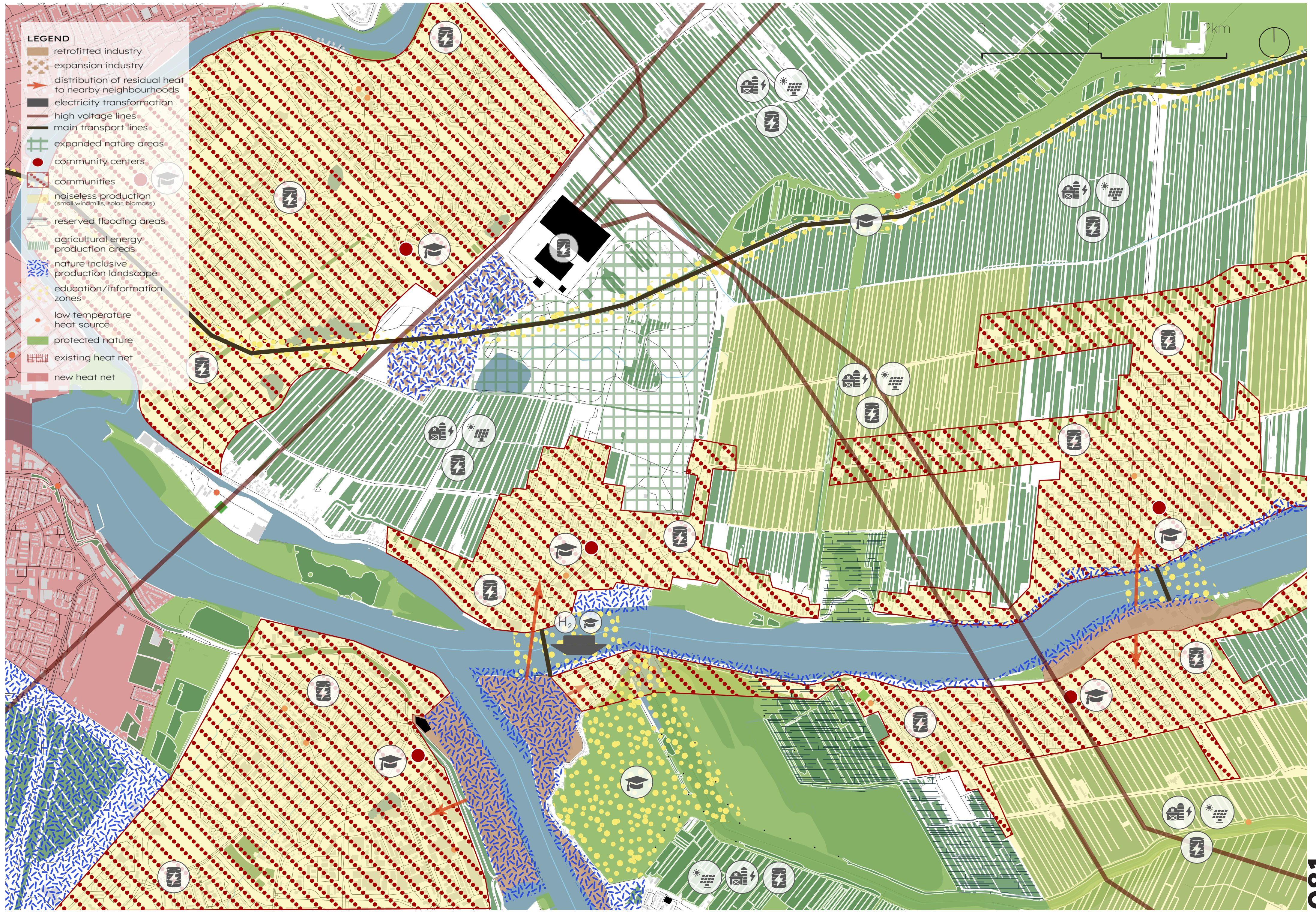


Figure 52

HOW & WHEN TO GET THERE

Strategy scale XS:
Between Rotterdam & Green Heart

Education and Awareness
This system can only exist with the cooperation of local residents, farmers and facilitating institutions. It is important to ensure all parties are well informed and educated about the possibilities of energy systems, regulations, support systems from the government and the cooperation. Herefore, residents and farmers can come together in the community centres with facilitating institutions or energy coaches to come up with initiatives and ask for advice and support.

This self-sustaining energy system can also exist elsewhere. By creating awareness of this system, it can be initiated in other areas. Public transportation like the bus and the ferry can help promote the area's energy system with information boards inside. Local energy farmers can have stickers on their products stating that they are "produced with locally generated energy". The cultural heritage zone of Kinderdijk can also become an education point where visitors can learn about the past and future energy systems. These promotions can then also increase the pride of residents and farmers and help strengthen the community.

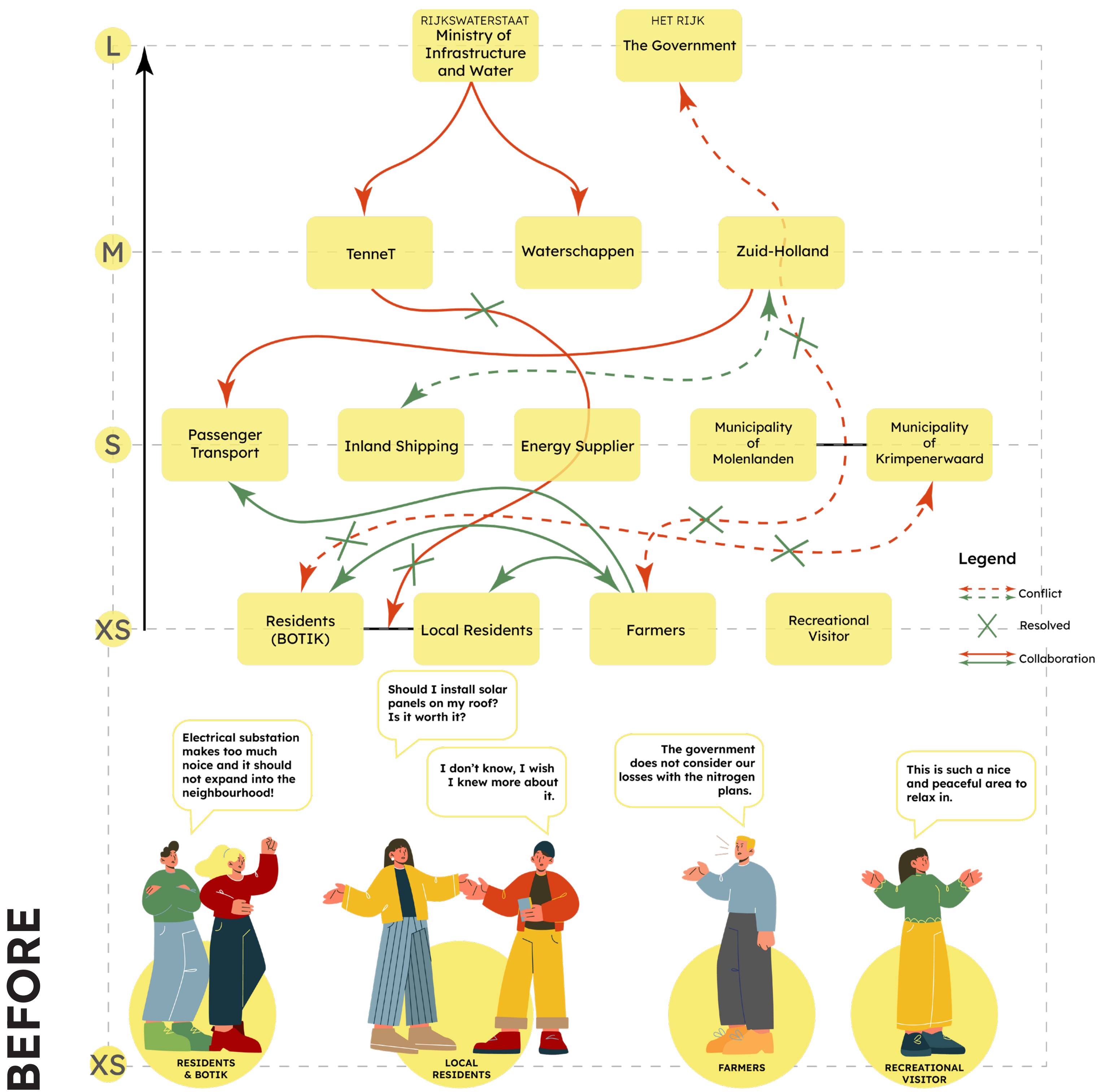


Figure 53

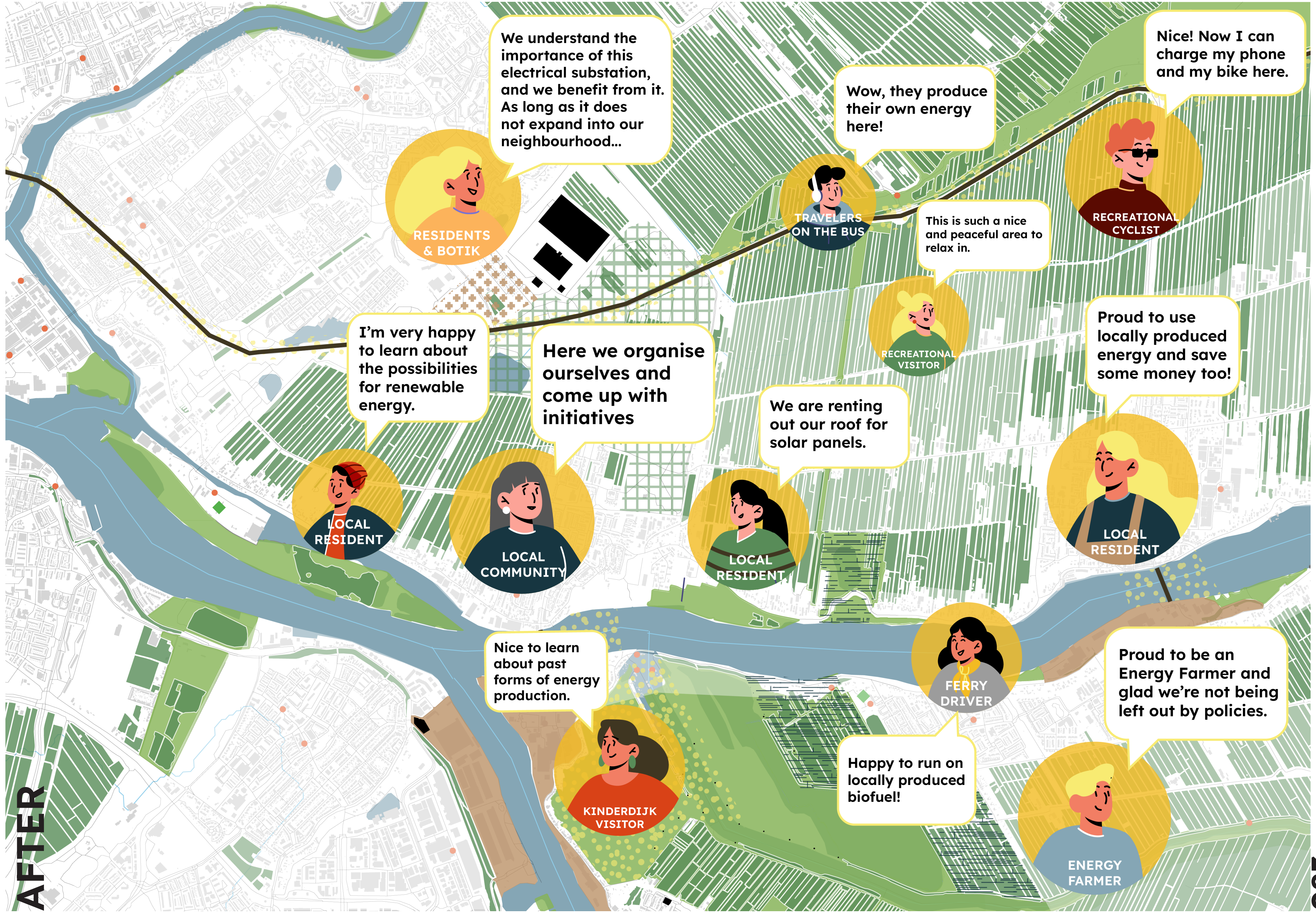


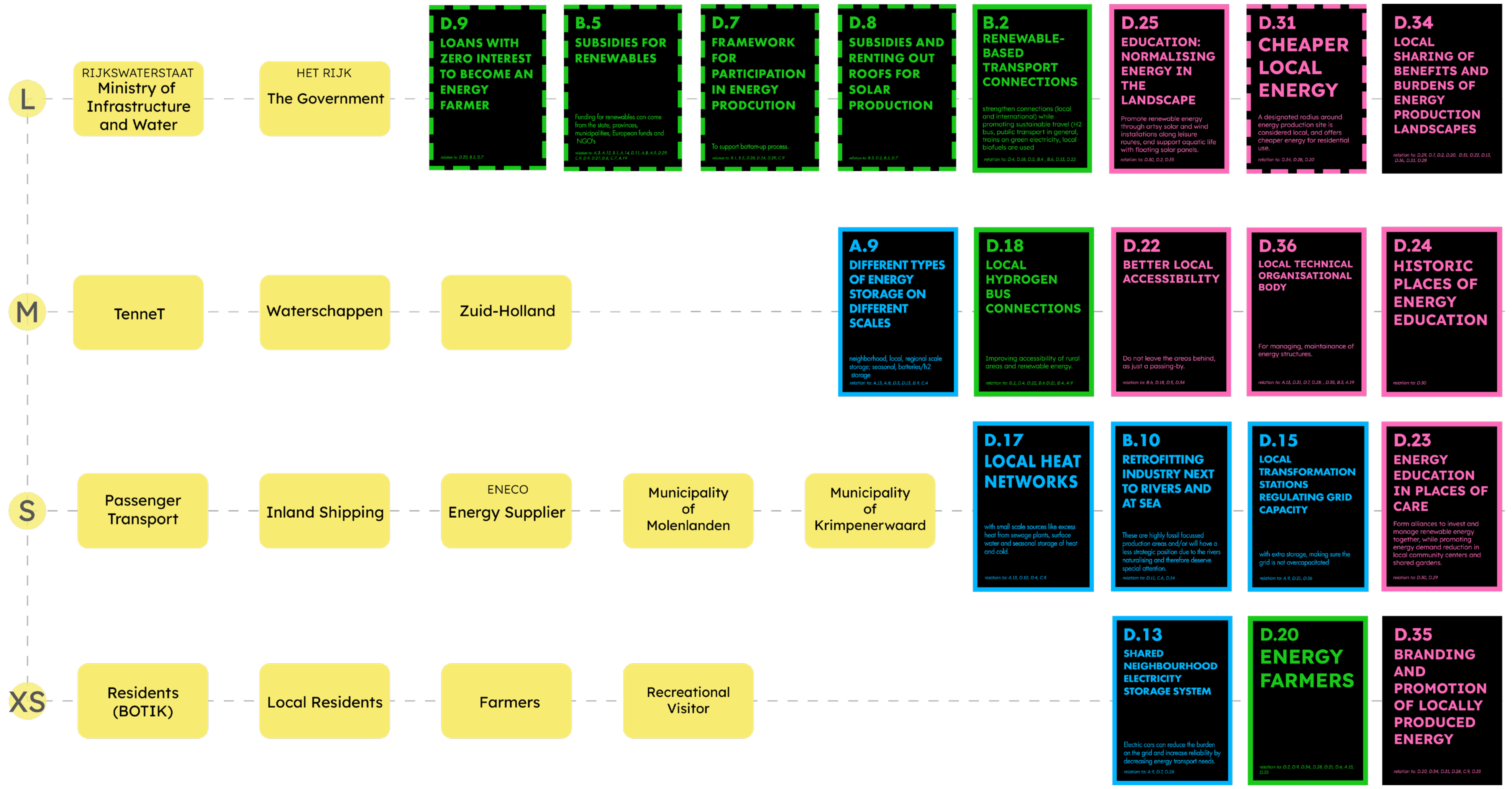
Figure 54

HOW & WHEN TO GET THERE

Strategy scale XS:
Between Rotterdam & Green Heart

Stakeholders and Patterns
Before this process can happen, some conflicts between stakeholders in this area need to be resolved first. Currently, the farming sector is protesting against the Dutch government's nitrogen policies as they do not effectively compensate the farmers' losses with the policies.

In this project's strategy, farmers get an opportunity and resources to transform their farms to an energy production landscape while strengthening their connection with nearby towns. There is one electricity transformation station in this area and the nearby residents are not happy about it. They complain about noise pollution and the stations planned expansions closer to the residential area. In the future, with growing energy demand, it is inevitable that the electricity substation needs expanding. The strategy reserves space for that further from the residential area. In addition, when the energy system becomes local and residents actively invest in it, we believe they can see the importance of the electricity substation and have more acceptance towards it.
Furthermore, patterns are explained in figure 55 and show their relations with the stakeholders. These patterns are also shown on the map to express their spatial impact.



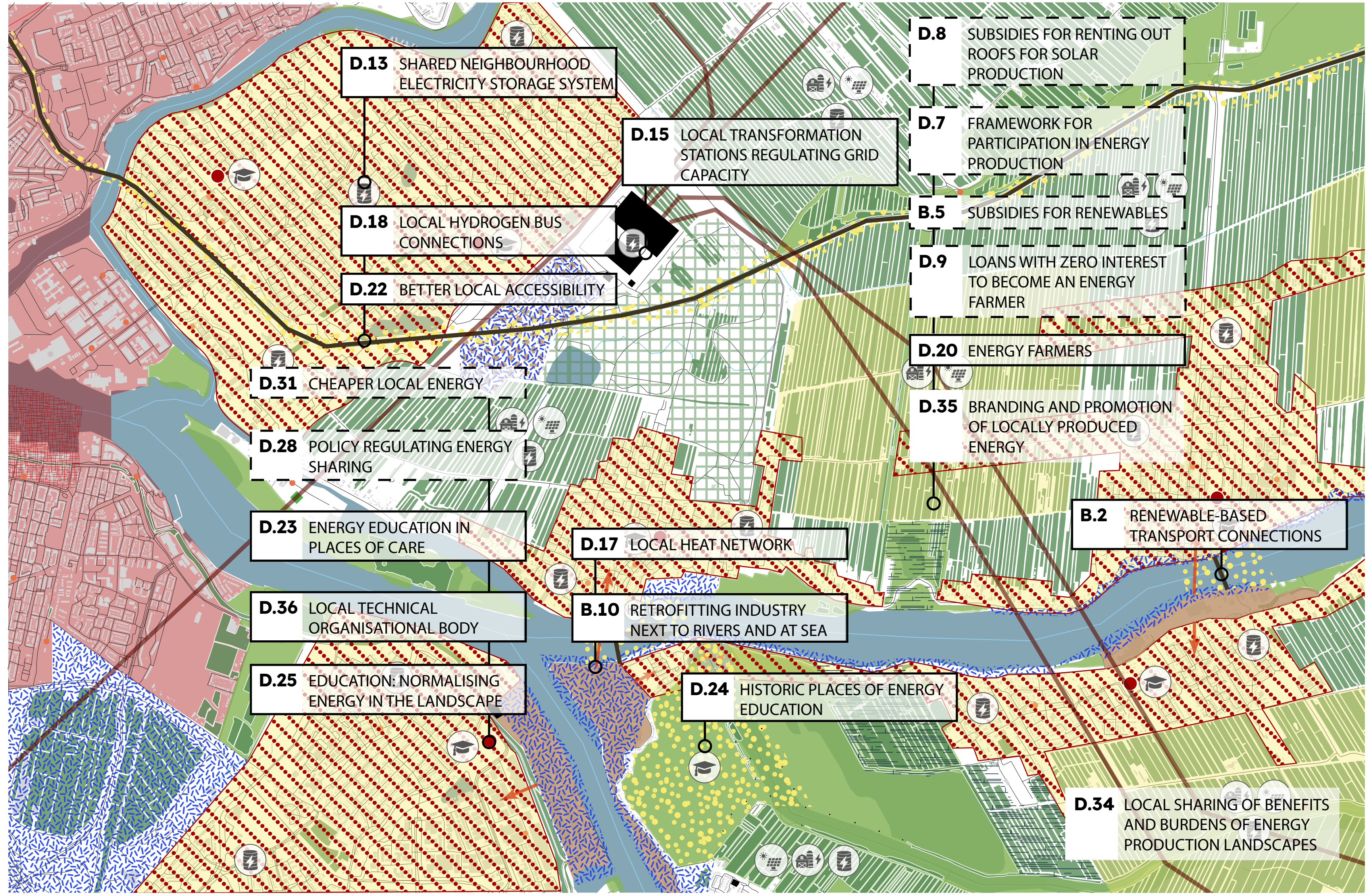


Figure 55

HOW & WHEN TO GET THERE

Conclusions

To conclude we shall revisit our research question:
How can we achieve a just energy transition in North West Europe & how can spatial planning, local-regional-international policies & cooperation support them?

Our spatial planning strategy exhibits a fractal nature, demonstrating its adaptability at various scales. At a large scale, our primary goal was to consider geopolitical security, while at a medium scale, our strategy was adapted to define and connect different hubs spatially and policy-wise. On a smaller scale, two distinct feedback loops and outcomes were identified, one focusing on energy production and the other on welfare and awareness.

The implementation of our strategy facilitated the formation of new relationships and the connection of existing ones, across different power positions, including top-down and bottom-up. Such interconnections not only aided the implementation process but also resulted in a paradigm shift when exploring a specific region.

Throughout the strategy process, we observed a shift in interest, which was reflected in our approach toward connecting our four pillars, namely, social justice, geopolitical security, ecology preservation, and resilient energy transition. We recognized the critical role of infrastructure and transportation in ensuring the success of our strategy, and also considered the expansion of the energy landscape and reduction of CO_2 emissions from agricultural lands.

Just as spatial justice is a complex term, obtaining it is an equally complicated process. Our research, actions, strategis, patterns as a participatory tool were all attempts to achieve it. Interscalar approach and multidimensional research created a framework that is able to include everyone and everything in the project.

Figure 56

WHAT DID WE LEARN?

Reflection

During the third quarter of the Urbanism Master track we had to face complexity of the regional scale of North West Europe at the same time managing equally complicated team work. We all definitely learned a lot from each other and this experience. We worked together on every step of our project to make sure that everyone was acting in accordance with their values. During this process we discovered dilemmas and diverse views that strengthened not only our concept but each of us individually.

Because of the time limit of the course, we were not able to explore every element of our research, which we will elaborate on in the discussion. We did manage to develop a multiscalar energy system on multifunctional landscapes. What is important to point out is our focus on cross border cooperation, which we believe are key to a resilient energy network. Since energy transition is an ongoing process we were more attentive towards the position of local communities in those changes. We adapted a pattern language to our own context and set the basis for future participatory projects that touch issues of just energy transition.

We have created an evaluation tool that is based on our conceptual framework. In this way we reflect back on our values and revisit it through social,ecological, geopolitical lenses. There is a noticeable lower focus on reducing energy demand in each of the above. On the other hand other dimensions were higher scored in our strategy. Obviously true outcomes can be measured and evaluated only when the strategy and tools are executed. But overall aiming for higher points on the R ladder and including geopolitics in the framework allowed us to reach better results in energy transition strategy.

Discussion

Because this project is limited by the duration of the course, some aspects of research are not yet complete.

In the beginning of the project, geopolitics were one of our bigger focus points as we also researched global trade interdependence. However, when zooming into local regions, geopolitics became a background task. In future research, tools to further strengthen geopolitical relationships can be developed, especially how to build trust and reliability.

In order to successfully phase out fossil fuels, we proposed a retraining program for workers in the fossil industry. This program will ideally be government funded, but precise details need to be worked out in future research.

In this report, we mentioned incorporating education and energy coaches as tools to support local initiatives. However, we did not have the time to further explain how this energy education will actually look like and what will be in the program. Following up research will explore this and also set boundary conditions for energy coaches and qualities they must meet.

Ethical reflection

The topic of energy transition embodies several social issues: affordability, accessibility and acceptance. Currently, the energy demand is increasing while the energy grid becomes more overloaded. In addition, energy is not affordable and accessible for everyone, especially since recent events like COVID-19 and the war between Russia and Ukraine. This project aimed to tackle these issues within the framework of spatial and social justice and create public goods accordingly.

Our strategy focused on co-creation of energy landscapes. We worked with different scales and proposed policies and spatial plans which ensured that top-down actions facilitate bottom-up initiatives. For example, the government should create and maintain energy infrastructure that supports decentralised, local energy systems. The goal of this approach is to engage stakeholders who currently do not have enough power and resources, like local residents and farmers, to contribute to the energy transition while giving them tools (pattern language) to co-create their future spatially. This way there will be more acceptance towards renewable energy and its spatial impact because the energy transition becomes a common goal. Top-down actions like subsidies, education plans and energy coaches should provide support to these stakeholders and ensure affordability of energy. Creating this decentralised, local energy system in rural areas will increase the accessibility of energy as the production becomes local and manageable within communities. The public goods we create with this strategy are: healthy energy landscapes, with clean air and access to green included; energy education; energy security and strengthened international cooperations. With this we've created tools and guidelines to also tackle the issues of affordability, accessibility and acceptance of renewable energy in the future.

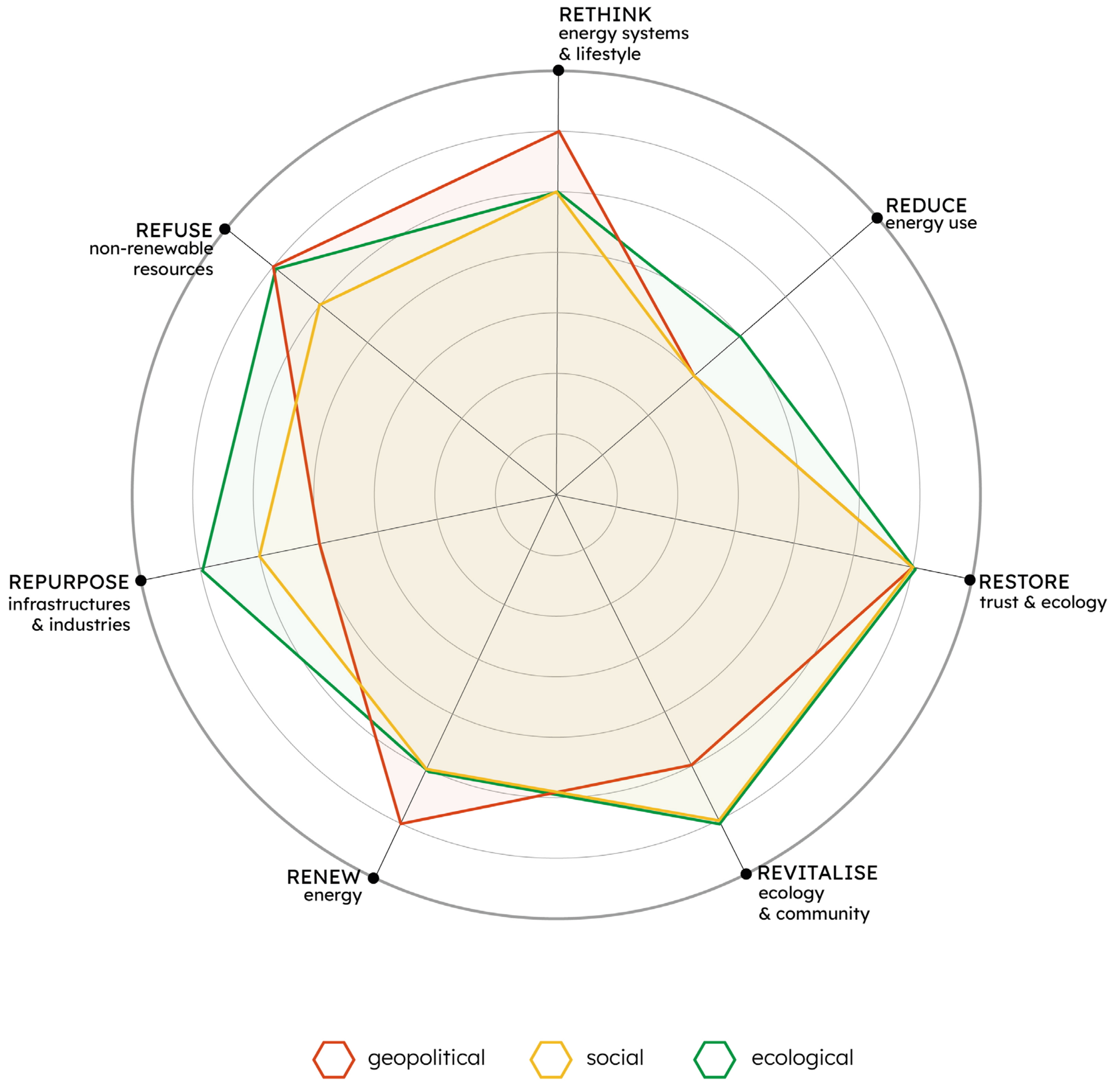


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Figure 56

Collage made of AI midjourney generated pictures and painting ‘View of Dordrecht’ by Jan van Goyen

APPENDIX

Individual reflections

Hasan Hashas

When we commenced our group project, I was captivated by the idea of social justice. Nonetheless, after participating in one of the SDS and Capita selecta lectures, my focus shifted to maritime planning, although not entirely. Working together as a team with various interests was a challenging task. As a result, we had to achieve balance and comprehension of varied interests individually and as a team, leading to the query, "What is the relationship between research and design in our group project?" This question became the driving force behind our process.

The lectures and workshops we attended presented us with a wide spectrum of tools and strategies, which helped in shaping our vision, conceptual framework, stakeholders, and strategy. These sessions were enlightening to me, as they provided a deeper understanding of every stage of our project. We applied the Delft method, which pushed us towards incorporating input and inspiration from lectures and workshops, leveraging our design skills, and conducting deep research to fill in missing information and gaps. As we progressed through the project, we continued to move back and forth, building up our argument, and defining limits.

The most valuable lesson that I learned during the project was the art of breaking down complex processes into smaller ones. The various stages, including shaping, regulating, simulating, and capacity building, were instrumental in this regard. Additionally, The variables of persuasiveness worked as a bridge between the academic and professional real-life approach, linking theory and practice. Overall, the project enabled me to acquire a comprehensive understanding of the relationship between research and design, which was crucial to the success of our project. I believe that the tools and strategies that we acquired during the SDS and Capita selecta lectures will be indispensable in my future pursuits.

Arjanne van der Padt

Today, April 12th, it is 'Dutch Overshoot Day'. This means we have already passed the limits of biocapacity for the coming year ("Persbericht Dutch Overshoot Day 2023 - Earth Overshoot Day," 2023). This statement clearly points out that we need to change the way we live, and for that also the environments we live in. One of the issues pressing on the planet's and our own health is our dependence on fossil fuels. Our project tackles this issue, presenting the alternative of just and resilient energy networks in the Netherlands and its surroundings.

The design studio started with an excursion, visiting the rural landscapes of South-Holland. From this small scale, the studio made the jump to the area of North-West Europe. How to research and design on such a big scale and link this to the scale of South-Holland was the first challenge that presented itself in our regional design project. The complexity of the wicked problems that present itself throughout all these scales seemed endless. But the project was not just one of spatial challenges, but also policy recommendations, stakeholder involvement and social goals, like creating the common goods (for example energy security). Working with these society and justice focussed topics, introduced in the methodology course parallel to the studio, I learned that a project aiming to be sustainable, can never truly be sustained if social and spatial justice are not addressed.

In our project, we translated this to "leaving no one behind", which presented the big challenge of getting everyone on board: dealing with multi-level governance (working throughout scales and in between private, public and civic stakeholders (Bache and Flinders, 2004)). To me, this became one of the most interesting parts of the project. For example in giving a spatial dimension to cross-border trust and collaboration, facilitating Triple Helix collaborations or Public Private Partnerships to retrofit fossil industries and infrastructures into a renewable based energy system and designing participatory processes in rural areas with local stakeholders. This made me question my own thinking, leaving prejudices behind, when we for example rebranded NIMBY'ers to ROHAC (Team Stadszaken, 2022). In "leaving no one behind", we created the just and resilient energy networks, which would not have been truly resilient and interesting to work on, without the social and geopolitical dimension.

But before we came to these results and conclusions, we needed to work through the inter-scalar complexity. Structuring our thoughts with existing literature-based concepts, like the R-ladder, X curve and a Pattern language, was very helpful in our process. This made me realise not to reinvent the wheel, but rather to carefully use it or re-design it to fit the context of your project. These concepts, together with methodology workshops and tutor sessions gave our group work the pushes we sometimes needed. I enjoyed working in our team. Even though it was not all smooth sailing, we communicated openly and resolved conflict in an open way. I learned a lot in the team project, not just about regional design, but also about general norms and values for teamwork, like trust and respect, which will always be a big part of urbanism, on every scale.

APPENDIX

Individual reflections

Małgorzata Rybak

As regional planning was a main focus of the third quarter of the MSc Urbanism curriculum, our group was tasked with developing a comprehensive plan for North-West Europe that took into account various factors such as the environment, socio-economic conditions, geopolitics and cultural heritage.To answer the question: What is the relationship between research and design in your group project? From the beginning of the research it was important for us to work between the scales to fully understand the complex system in which we create our design. Through extensive analysis, we have explored the knowledge of renewable and non-renewable energy sources, infrastructure related to electricity and the consequences of energy production. This broadened our understanding of those complex international systems in political, social as well as environmental dimensions. We used that knowledge further in the design of the strategy on multiple scales with the introduction of a participatory tool - pattern language.

Throughout the process, we made use of the knowledge gained during the Methodology, Capita Selecta and Spatial Development Strategies (SDS) lectures and workshops. The SDS lecture series introduced complexity of theory, terms, and practice examples that helped us to understand interconnectedness of various factors in the regional context. We learned about strategic planning, circular economy, planning tools (ex. pattern language, scenario building), terms like resilience or panarchy.

The Capita Selecta series, on the other hand, provided us with a deeper understanding of specific topics related to regional design such as sustainable development, social and ethical issues, governance and policy terms. I consider them extremely important because they repeatedly undermined the status quo, encouraging us to explore our own views or defining terms that are very complex and challenging ex. lecture on Spatial Justice by Caroline Newton. They went hand in hand with studio progress which definitely helped in development of research and design. I also appreciate the engaging way of conducting classes.

This group project was an important lesson of teamwork. We learned about our strengths and weaknesses, how to talk about conflicts and how to celebrate our successes, how to trust in the knowledge and skills of another person and, above all, how to find a consensus of views on such a complex project. It helped me to develop my collaboration and problem-solving skills, which I believe will be useful in my future career.

In conclusion, the regional design process was an incredibly valuable experience that taught me a great deal about the complexities of regional design and connected with its research, the importance of considering various factors and scales when developing a design. Complexity of such a scale made me more humble and respectful towards its influence on local communities.

Jing Spaaij

What is the relationship between research and design in your group project?

As I just started the Urbanism Master track at the Faculty of Architecture and the Built Environment with this course, I at first was a little worried there would be a knowledge gap on regional design. Throughout the course, the Methodology, Capita Selecta and Spatial Development Strategies (SDS) lectures and workshops gave me essential insights on the theories and methods of regional design. The lectures, especially in the methodology course, were structured in line with the project development. This has helped not only me but also my teammates to stay on track with the project and discuss important elements at the right moments. It has also helped us to connect research with design. All this has made me more confident in my abilities throughout the studio.

The beginning of the studio was focused on orienting the team's interest and formulating our research. I experienced this part as quite arduous as our team struggled to formulate a concrete research question. Our general interest in a wide variety of topics had become an obstacle for us. Eventually, we settled on the topic of energy transition as it also covers a wide variety of disciplines. However, the lectures and our own research has shown us the great amount of missing links between the feasible change and the change needed to achieve climate goals by 2050 (Wandl, 2023; Hein, 2021). Throughout this phase, it has become clear that regional design was the most important step towards a circular economy.

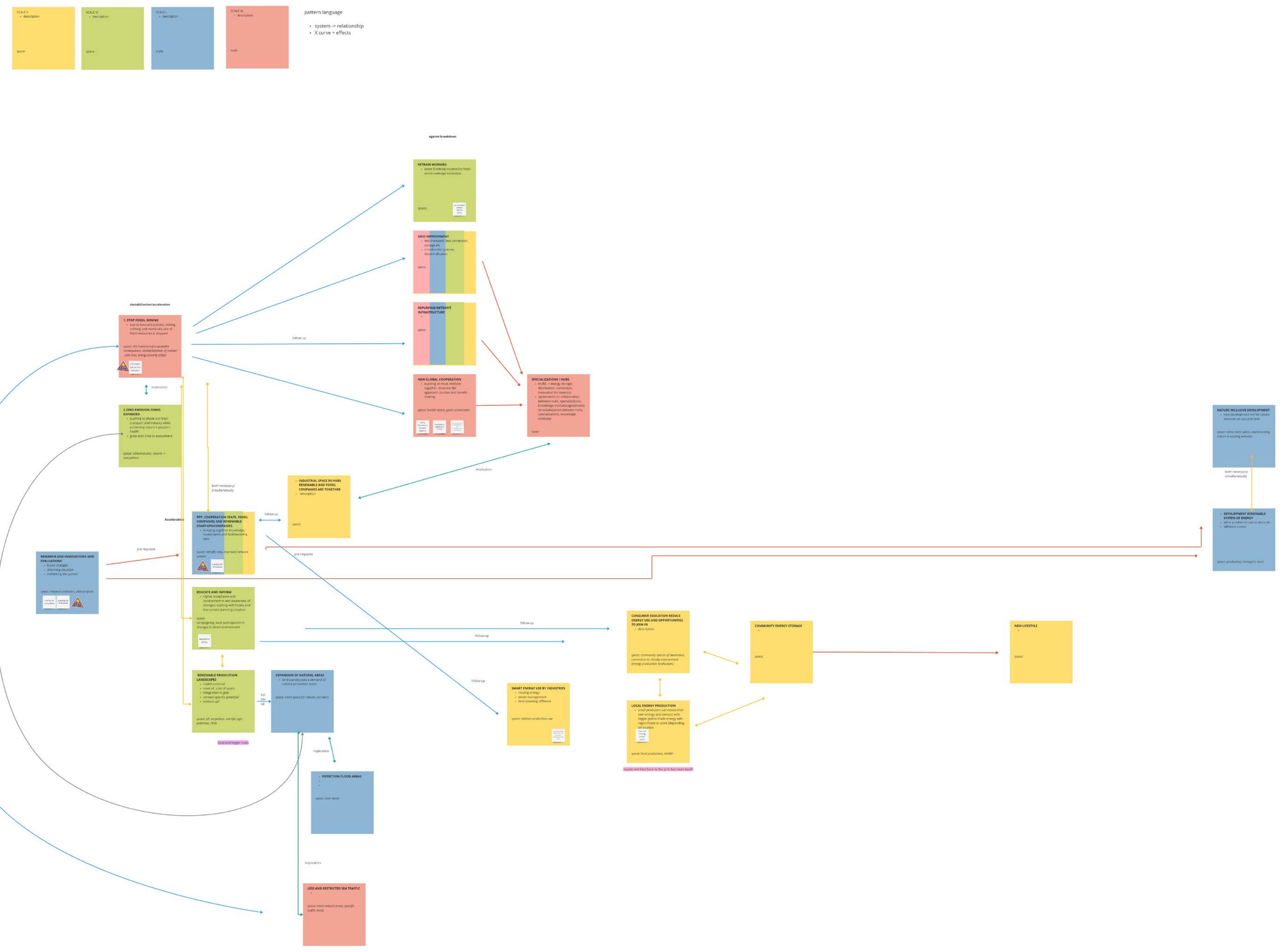
The lectures have also teached me that everyone can contribute to a circular economy and regional design. In addition, they have intrigued me more about the topic of social and spatial justice. These aspects have made our project more complex but also very educational and interesting. Because of this, I sometimes had trouble finding the fine line between deep diving into research and starting to produce concrete products for design. Overall, I am grateful that this course provided me with so much knowledge and insights about very topical subjects and has given me the opportunity to explore the boundaries of regional design.

Aside from concrete knowledge, this course has also taught me the complexity of cooperation in regional design. The amount of stakeholders involved through different scales was almost overwhelming. Through the design phase we learned about their objectives, interests and positions in the power matrix. The character of their cooperation and conflicts can more or less also be found in our team's cooperation. Each individual has had to compromise their vision of the project and defend their points of view when needed. The team's design discussions were very much based on our research but also our own logic. Personally, I think I've made progress in explaining the reasoning behind my vision and to think critically about consequences of design actions.

Overall, this scale of design has gained my interest because of its complexity and the need for in-depth research. With all the knowledge and skills gained from this project, I feel more confident in contributing to complex projects in the future.

APPENDIX

1. matrix diagram patterns (progress)



LEGEND

scale:
A: international
B: national
C: regional (for example a province)
D: local (city-neighbourhood)

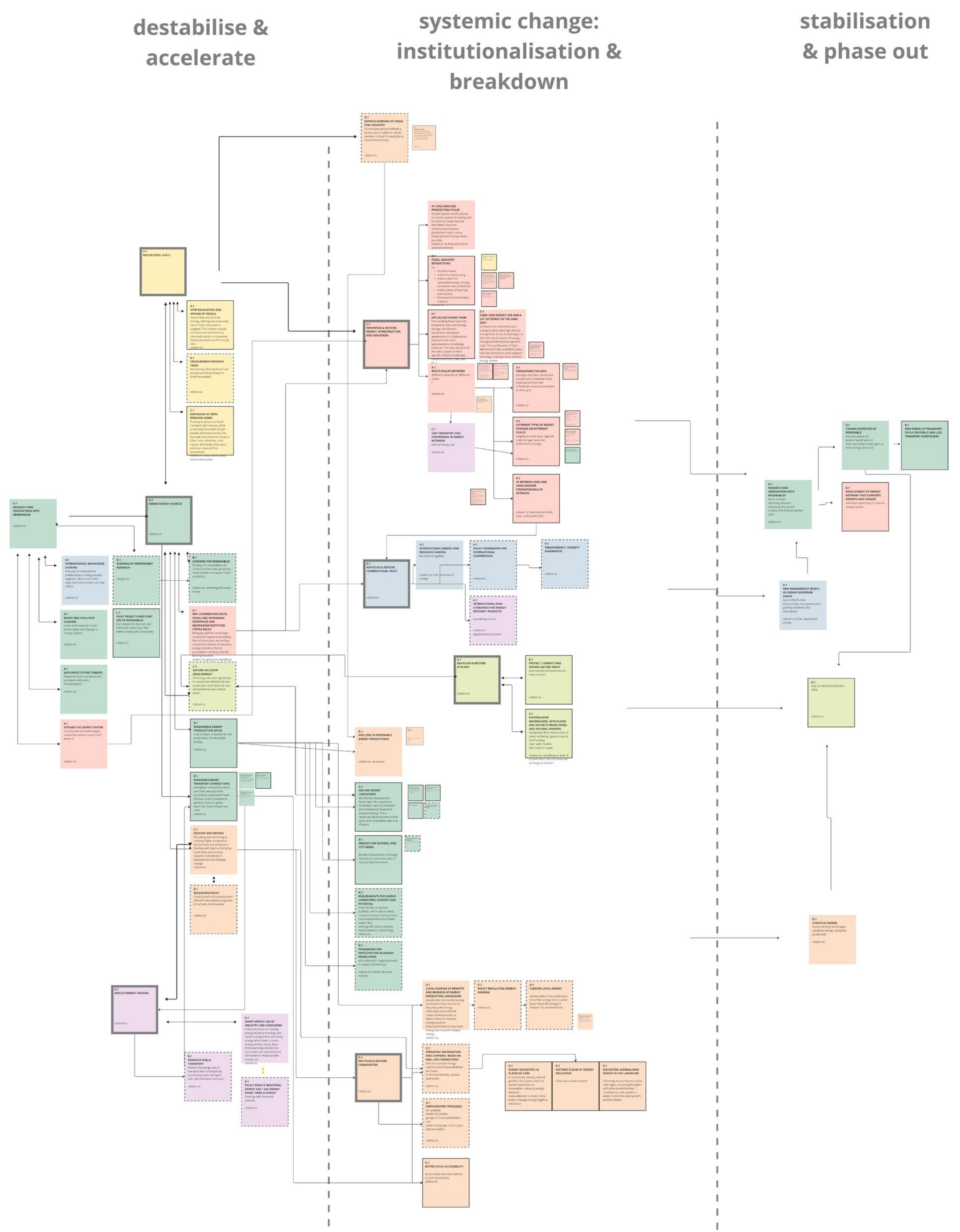
Type of pattern:
Strategy
Spatial action
Policy

Spatial | Policy | Main Strategy: Strategy

example: A.1 TITLE — description — *relation to:*

Cards GOALS
- Refuse fossil fuels
- Reduce energy demand
- Renew energy sources
- Revitilise & Restore Ecology
- Revitilise & Restore Communities
- Revitilise & Restore Trust
- Repurpose infrastructure and industry
- Rethink Inftrasturcture and industry

A.1 REFUSE FOSSL FUELS *relation to:*	D.1 REDUCE ENERGY DEMAND *relation to:*	A.1 RENEW ENERGY SOURCES *relation to:*	B.1 REVITILISE & RESTORE ECOLOGY *relation to:*
D.1 REVITILISE & RESTORE COMMUNITIES *relation to:*	A.1 REVITILISE & RESTORE INTERNATIONAL TRUST *relation to:*	C.1 REPURPOSE & RETHINK ENERGY INFRASTRUCTURE AND INDUSTRIES *relation to:*	



APPENDIX

2. Power-Interest matrix of stakeholders

	Actors with production power	Actors with blocking power	Actors with diffuse power position
Proponents	• state own companies EBN • EU • UN • Dutch government & muncipalities • <u>critical proponent</u>: Rijkswaterstaat • renewable energy industries • start ups in renewables • Ports Authority	• <u>critical proponent</u>: activists (Green Peace, Justice) • copmanies of raw materials production • UNESCO	• Citizens living next to industry • future generations
Opponents	• companies of fossil fuels (shell)	• companies of fossil fuels (shell) • farmers • industry workers • shipping industries	• CItizens living next to renewable industires
Fence sitters	• housing cooperation • banks • investor/ retirement comapnies • infrastructure companies • chemical industry • food industry	• WWF • chemical industry • food industry	• Citizens: city ppl • imigrant workers • energy consumers